JUNE 1st, 1885

WESTERN MANUFACTURERS

MUTUAL INSURANCE CO.

MONTAUK BLOCK,

Nos. 113, 115 and 117 Monroe Street, CHICAGO.

SPECIAL REPORT No. 7.

AUTOMATIC SPRINKLERS

FIRE DOORS.

BLANKETS, FIRE PAILS AND WASTE CANS

ALSO PRESENTED WITH THE COMPLIMENTS OF THE COMPANY

SPECIAL REPORT No. 18,

Boston Manufacturers Mutual Fire Insurance Company.

CHICAGO:
JOHN MORRIS COMPANY, PRINTERS
1885

Western Manufacturers Mutual Insurance Co.

SPECIAL REPORT No. 7.

AUTOMATIC SPRINKLERS.

The increasing number of devices offered to the public under the name of Automatic Sprinklers calls for a few words of explanation and warning on the part of this Company and those Companies associated with it.

In our opinion the system of Automatic Sprinklers offers the most perfect protection yet devised against fire loss, not absolutely perfect, for we have not yet learned to create machinery incapable of derangement or ultimate improvement, but carried to that point where it has become of very great value, and where further improvement must be necessarily slow.

It must not be inferred that all Sprinkler Systems are thus indorsed. Some "heads" on the market are radically defective, some of doubtful value, and others are but a revival of forms already tried and found wanting. It does not follow because a device is advertised as Automatic that it is really so, or if so that it is effective for the purpose designed.

The chief danger arises from the competition induced by the necessarily high cost. It must be remembered that in equipment the cost of the Sprinkler heads themselves cuts no great figure, and that the *difference* between the highest and lowest priced of these will fall below 7 per cent of the cost of the entire work. So that where a greater difference exists between estimates it may possibly be at the expense of arrangement for water supply and proper piping.

The requisites of a Sprinkler service, all of which are practically complied with by several systems, are these:

1. A Sprinkler head *sensitive* enough to open promptly and *ahead* of the fire, tight enough to be secure from leakage, *substantial* in construction to resist the continuous water hammer, and a *good distributor* throwing the spray evenly over a reasonable area and thoroughly wetting every portion. The valve must be closed by materials not liable to adhere on account of age, heat or corrosion, and by whatever device the valve is closed the parts must move quickly and freely that the flow of water may not reach and harden the solder prematurely.

2. The *pressure* on the highest or most remote Sprinkler should *never* fall below ten pounds, and *twice* that figure is desirable.

3. Water supply must be in excess of the amount required to supply all of the Sprinklers that can be expected to be opened at one time, and the sources of supply ought to be two or more in number, each adequate in itself to supply the necessary amount of water where any possibility of failure of any one source of supply exists.

4. Tanks must be adequate to supply the Sprinklers at the required pressure for a length of time enough to put the pumps in motion to maintain the supply, and the pumps should be powerful enough and so arranged as to be put into prompt operation at all times.

5. Where steam fire engines have access to the property, connections should be provided to enable several of these to pump directly into the Sprinkler system, suitable relief valves and overflow pipes being provided.

All Sprinkler systems should be put in under the Supervision of a Competent Engineer.

In small pipes friction will nearly neutralize twenty pounds pressure at a distance of only fifty feet from the tank, leaving a mere dribble of water from the Sprinkler.

Competition as a rule prevents overcharge for piping, and it is safe to presume, in the absence of evidence to the contrary, that a *cheap job is a poor one*, and poor work in such cases is money wasted; it not worth doing at all unless worth doing well. Bids for Sprinkler equipment should therefore be refully scrutinized, to be sure that the difference in price is not at the expense of any essential feature of rotection.

The cost of an effective Automatic Sprinkler equipment usually *approximates* four cents per square foot of floor area to be protected, exclusive of pumps and auxiliary apparatus, and varying somewhat with conditions and character of risk.

It is impossible to tabulate sizes of pipes that will meet all conditions. Cotton-mills require larger piping and better supply than planing mills; flouring-mills more than cotton-mills. The following tables may be taken however as a fair standard, the first column of heads being a *maximum* for the most favorable circumstances; the second the standard fixed by the associated Mutual Companies of New England, but *not* a possible maximum, being applied to but few classes of hazards.

$\frac{3}{4}$	inch	pipe	will	supply	at most	1	head.	N. E.	Standard	1	head.	Prov'nce	Steam &	Gas	Pipe	Co.	1 head.
1	"	"	"	4	"	"	"	4	"	"	"	"	"	"	2	"	
$1\frac{1}{4}$	"	"	"	6	"	"	"	6	"	"	"	"	"	"	4	"	
$1\frac{1}{2}$	"	"	"	12	"	"	"	10	"	"	"	"	"	"	6	"	
2	"	"	"	24	"	"	"	18	"	"	"	"	"	"	11	"	
$2\frac{1}{2}$	"	"	"	40	"	"	"	28	"	"	"	"	"	"	17	"	
3	"	"	"	60	"	"	"	45	"	"	"	"	"	"	30	"	
$3\frac{1}{2}$	"	"	"	90	"	"	"	65	"	"	"	"	"	"	40	"	
4	"	"	"	128	"	"	"	80	"	"	"	"	"	"	60	"	

Distance from immediate source of supply and initial pressure will affect the maximum. The pipes given are the *smallest* effective sizes, and the maximum tables of heads in the highest numbers is based upon the assumption that not above one-fourth of the number of Sprinklers named will be brought into simultaneous action, the New England table on about one-third; the proportion, of course, increasing as the number of heads grows less. The third is that stated as used in practice by the Providence Steam and Gas Pipe Company; it is claimed as calculated to allow for a uniform loss of head by friction, and if adhered to would appear to be fully adequate in all cases, and is therefore to be preferred to the others as a guide.

There is reason to believe that considerable Sprinkler work is improperly done and would not meet the requirements, and to fear that really effective systems may suffer in reputation as a result of destructive fires in so called protected premises, due to the imperfections here mentioned. A suspension of judgment is asked in such cases until an investigation can be had, the cause of failure impartially stated and the best remedy suggested.

Complaints reach us frequently of corrosion of pipes and sprinklers, especially the former, from chemicals. We deem it inadvisable to admit any chemical solutions into the pipes, decidedly preferring some system of compressed air where there is danger of freezing.

Attention is called to the necessity of taking water-level in tanks at frequent intervals, or of a daily reading of gauge where pressure tanks are used and of frequent inspection of alarm apparatus and valves. The latter as a rule should be sealed or strapped open. Valves in supply pipes have been found closed, and gongs out of order in several cases.

We desire by every legitimate means to promote the adoption of effective Sprinkler systems by our members, and will at all times aid them in the selection to the best of our ability. We believe, however, that a Sprinkler service like a bridge or other engineering work should be theoretically adequate for much more than is ever expected of it in order to guard against emergencies.

FIRE DOORS AND SHUTTERS.

There seems to be some misunderstanding among our members as to what is approved by our Companies as an adequate fire door, and to the end that this may be corrected, we append specifications for such doors and shutters prepared by Mr W. B. Whiting, of the Boston Manufacturers Mutual Insurance Co.

Specifications.

A door of the right construction to resist fire should be made of good pine, and should be of two or more thicknesses of matched boards nailed across each other, either at right angles or at forty-five degrees. If the doorway be more than seven feet by four feet, it would be better to use three thicknesses of same stuff; in other words, the door should be of a thickness proportioned to its area. Such a door should always be made to shut into a rabbet, or flush with the wall when practicable; or, if it is a sliding door, then it should be made to shut into or behind a jamb, which would press it up against the wall. The door and its jambs, if of wood, should then be sheathed with tin, the plates being locked at joints and securely nailed under the locking with nails at least one inch long. No air-spaces should be left in a door by paneling or otherwise, as the door will resist best that has the most solid material in it.

In most places, it is much better to fit the door upon inclined metal slides rather than upon hinges.

This kind of door may be fitted with automatic appliances, so that it will close of itself when subjected to the heat of a fire; but these appliances do not interfere with the ordinary methods of opening and shutting the door. They only constitute a safeguard against negligence.

The construction of shutters varies from that of doors only in the use of thinner wood.

As a substitute for these, where a door may be of lighter construction, the Dolman patent door noticed in Special Report, No. 6, of this Company, will be found useful.

INADEQUATE FIRE DOORS.

Under this head may be classed *all* doors of iron, whether sheet, plate, cast or rolled, single, double, or hollow, plain or corrugated, none of which are capable of resisting fire for any length of time; also wooden doors covered with tin on one side only or covered with zinc, which metal melts at 700 degrees Fahrenheit.

The wooden door covered with tin only serves its purpose when the wood is fully encased in tin, put on in such a way that no air, or the minimum of air, can reach the wood when it is exposed to the heat of a fire. Under these conditions, the surface of the wood is converted into charcoal; and charcoal, being a non conductor of heat, itself tends to retard the further combustion of the wood. But, if air penetrates the tin casing in any measure, the charcoal first made, and then the wood itself, are both consumed, and the door is destroyed. In like manner, if a door is tinned only on one side, as soon as the heat suffices to convert the surface of the wood under the tin and next to the fire into charcoal, the oxygen reaches it from the outside, and the door is of little more value than a thin door of iron or a plain wooden door.

A device or automatic thrust joint providing for the automatic closing of fire doors, which is highly recommended by Mr. Edward Atkinson, is made by the Providence Steam & Gas Pipe Company, of Providence, R. I. It is capable of attachment to either sliding or swinging doors, and is cheap and apparently well-made and effective.

BLANKETS.

Excellent use has been made in many instances of coarse blankets in protecting buildings from the spread of fire from adjacent risks, and in extinguishing interior fires in inflammable substances that are or become fluid in combustion. The methods of use are mainly hanging on sides of buildings or over windows and throwing water upon them, in the latter case often from the inside, or dipping in water and using to smother a fire. Many serious conflagrations have been arrested by this means. The situations where these can be used to advantage will, in the main, indicate themselves, but may from time to time be suggested by our Inspectors. They would probably be of great value in arresting fires in lumber.

FIRE PAILS AND WASTE CANS.

As stated in Special Report No. 6 of this Company, arrangements have been made to furnish our members with metal fire pails and waste cans at the following prices, properly branded: Fire pails, 10-quart, $4.00 per dozen; 14-quart, $6.00 per dozen; waste cans, small size, $18.00 per dozen; large size, $24.00 per dozen. Where members prefer procuring the goods in open market to ordering through this office, the following should be observed: Fire pails should be of medium weight, of best quality galvanized iron, and should hold between ten and fourteen quarts; rims should be strengthened with heavy wire, and the use for which the pail is intended should be painted on it in large black or red letters. In large establishments it is often well to number the pails, and to paint those of each different floor or section a particular color.

Pails are best hung on pegs, and if water is kept in casks instead of the pails the latter should hang near by. An axe and bar for fire purposes should always be placed at a convenient point or points. Large risks require several of these, especially flouring mills.

Waste cans should be constructed after the following specifications: Small size, capacity eight to ten gallons, to be of heavy galvanized iron throughout, and stand on strong iron legs not less than two and a half inches clear from floor; covers self closing and tight. All joints should be turned *and riveted:* it is not permissible to solder *any* joint; legs should also aid rivets in supporting bottom; handles or bales should be attached for convenience in carrying and emptying. The pattern we prefer is half round, with sloping cover somewhat after the shape of a parlor coal scuttle, which makes it difficult to apply the cans to other uses.

Boston Manufacturers Mutual Fire Insurance Co.

Special Report No. 18.

I.

FINAL REPORT ON LUBRICATION

AND UPON

THE SPONTANEOUS COMBUSTION OF WASTE.

In the quarterly report of the Associated Mutual Companies upon fires for three months, which was lately issued, reference was made to five fires which had occurred from the spontaneous combustion of waste in a cotton mill, in which an oil had been used for lubrication consisting of a fine mineral or paraffine oil said to have been mixed with what purported to be pure neats-foot oil. The proportions of the paraffine and of the neats-foot oil were such that no spontaneous combustion could have occurred had the mixture been complete, or had there been no separation of the two oils after the mixing.

Of the neats-foot oils, there was one kind which had been chemically treated for the removal of extraneous substance, and for which it was claimed that there was no liability to spontaneous combustion, even in respect to the pure oil, without the mineral. The other varieties were given qualities such as are sold in the open market.

The particular oil claimed to be free from liability to spontaneous combustion has been tested in the apparatus invented by Prof. J. M. Ordway, and now under the charge of Mrs. E. H. Richards, in the Department of Sanitary Chemistry of the Institute of Technology.

In trial No. 1 a ball of cotton waste, oiled with pure lard oil, was placed at one end of the apparatus; a similar one, oiled with pure neats-foot at the other. At the end of four hours the temperature of the ball oiled with lard oil had risen to 220° C. (428° F.), and the ball was withdrawn. The ball oiled with pure hoof oil remained an hour longer before the temperature began to rise. At the end of the sixth hour it was 230° C. (446° F.), and was withdrawn. In half an hour it was a mass of glowing coal, which a slight breath caused to burst into flame.

Trial No. 2 was with a ball oiled with pure neats-foot oil at one end, and a ball at the other end oiled with a mixture of 50 % neats-foot oil and 50 % "paragon oil," or pure mineral oil. At the end of the same time as in trial No. 1, — namely, the five-hour test, — the temperature of the ball oiled with pure hoof oil began to rise, and in another hour had reached 220° C. (428° F.). It was then withdrawn and quenched. The temperature of the ball oiled with the mixture did not rise above 101° C. (214 F.) although the test was continued through the seventh hour.

In trial No. 3, one ball was oiled with a mixture of 75% of the neats-foot and 25% of the mineral oil. The other ball was oiled with a mixture of 67% of the neats-foot and 33% of the min-

eral oil. At the end of six hours and a half the temperature of the latter ball had not risen above 101° C. (214 F.), and when withdrawn showed no signs of charring. The ball which was oiled with the mixture of 25% mineral oil reached a temperature some seven degrees higher than the other, and, when withdrawn, gave a slight odor, due to oxidation. The mixture containing 33% of mineral oil would appear to be quite safe.

The mixtures which were made some twenty days ago show no indication of a separation, and it is not probable that any will occur when the oils have been once thoroughly mixed.

In view of the danger which has occurred, although no loss was caused by the five fires named, it becomes expedient to raise the question whether or not it is worth while to mix any animal oil with a mineral oil, for the ordinary purposes of a factory, with the object of giving it greater body or viscosity.

Referring to the standard of a suitable and safe spindle oil, — to wit, an oil which will bear a fire-test of 300 ° F. or more, and which will evaporate not over 5 % in twelve hours at 140° F., — it will be remembered that the conclusions from our trials were that, for high speed and light pressures, such as affect spinning machinery, the greatest degree of fluidity consistent with the oil maintaining its place between the metal surfaces was the most desirable quality possible ; therefore the question arises, Can sufficient body or viscosity be given to a pure mineral oil to meet this necessity ? If so, anything beyond that point is an injury, and not a benefit, for this reason : the more viscous the oil, the greater the power required to keep the spindles in motion, because the particles of the oil itself, having a tendency to hold together thereby retard the motion of the spindle.

This is one of the principal points evolved by Mr. Woodbury in his experiments upon the friction of heavy bearings at low speeds.

The function of the lubricant is to keep the metal surfaces apart, or to prevent actual contact of metal with metal. Therefore, when there is a very heavy pressure upon a bearing, a viscous oil, or an oil possessing what is called a great body, is required ; but for light pressure and high speed, only just the measure of viscosity needed to prevent the lubricant from running down, so as to leave the metal surfaces bare, is all that is required.

Very important changes have been made in the preparation of spindle oils since the conditions of safety and efficiency were so thoroughly established by us ; and we may refer to the varieties of so-called heavy-bodied spindle oils which are offered by all reputable manufacturers, and we may especially refer to the experiments now being made by the Thompson & Bedford Co., of New York, to whom we have loaned our experimental spinning-frame and one of our testing-machines, in order that they may make use of them in their endeavor to meet the exact conditions required, and to furnish the safest and most suitable mineral oil which will require no admixture of animal oil to give it the true viscosity called for in each department of the work.

Our first testing-machine, on which the principal part of the work was done, is about to be set up under the charge of Professor Norton, in the Department of Industrial Chemistry of the Institute of Technology, where it may be made available for any future purpose.

There is little more practical work which can be done in the investigation of this subject in a laboratory.

The final conclusions, especially those derived from Mr. Woodbury's latest experiments on heavy bearings, both at high and low speed, may be summarized as follows, from his final report : —

Economy of oil may represent extravagance in the motive-power. A liberal supply of a very fluid oil may save motive-power at the expense of the repair account, if it does not stay in its place and thereby fails to keep metal surfaces from contact with each other.

Lubricants are wasted, not worn out, by attrition; and it is of as much importance to know how to use oil as it is what oil to use. Safety having been assured in the first instance, the problem consists in determining the relative cost of oil, power, and repairs. That oil is the best which will represent the fewest dollars expended on these three subjects; in comparison with waste of coal or wear of machinery, the prime cost of the oil itself is of little consequence.

In a broad sense, these questions cannot be solved by any experiments in a laboratory, nor can true economy be determined by any final *dictum* from any source.

Their solution will be found in the practical experience and in intelligent observation, sustained by all the resources of technical science. It may happen that each department of a textile factory or each kind of other work requiring lubrication may be best served by its own special oil: but there could be no inducement for carrying the selection of oil to so fine a point, except for the purpose of saving the wear of the machinery.

We may perhaps claim that by this series of investigations we have practically assured freedom from spontaneous combustion, in very large measure, if not absolutely.

We have laid the foundation of a true science in the matter, by the use of special machines invented during the progress of the work, with which more precise results have been attained than were ever reached before.

We have brought all the reputable makers of mineral oils to see the expediency or necessity of making the best oil that can be made, and the competition in the sale of oil to-day is rather to determine who can make and sell the best and safest oil at the lowest price consistent with a true quality, rather than in any attempt to impose upon our members volatile oils which, while they performed the work of lubrication sufficiently well, yet exposed the works in which they were used to very great danger. At this point we may safely leave the subject for others to continue the work.

During the progress of this investigation, especially in the latter part of the work in respect to heavy bearings, both at low and high speeds, Mr. Woodbury reached results which are of great interest to scientific men. They have been contributed in two communications to the American Society of Mechanical Engineers, and have been published in their Transactions.

We have procured extra copies of these papers, and will furnish them to any members who desire them, in answer to any request which may be made.

II.

LUBRICATING MIXTURES.

Our members are warned against purchasing or making use of so-called "lubricating mixtures," without careful examination.

There is one which comes up every now and then, of which the receipt was first sold under the name of Fink. This receipt was submitted to Professor Ordway, and was by him pronounced worthless, or worse, as there would be great liability to the journals heating by being left bare of any lubricant if this mixture were used or combined with the oil.

I have not the receipt at hand; but I am now informed that a mixture, supposed to be the same, is being offered. It consists mainly of French chalk and water.

In case it is offered to any member, it is suggested that he ask to have a pint sent to this office for examination, and it is not probable that after such request has been made that the purchase of the mixture will be pressed upon him.

III.

BITUMINOUS COAL—SPONTANEOUS COMBUSTION.

The liability of bituminous coal to take fire by spontaneous combustion has always made it necessary for this Company to require that it should not be stored in any buildings in which other property insured by this Company would be exposed to danger.

We have made one or two exceptions in favor of certain kinds of coal; but hereafter we shall be unable to say that there is any kind of bituminous coal free from the liability to heat. There are some varieties that have never been known to heat to such a degree as to create noxious gas or to ignite; but we cannot be sure that they may not, because the liability is chiefly due to the presence of small particles of pyrites and sulphur, rather than to any general diffusion of either, through the mass of the coal; hence the ordinary analyses of the coal may be entirely misleading.

On the other hand, the relative prices of bituminous coal, as compared to anthracite, make it almost a necessity for members to make use of it, provided it can be done safely; and its use is rapidly increasing.

Heretofore we have given to special members, few in number, whom we knew to be in the habit of purchasing bituminous coal, a warning as to its danger, by means of a special circular, which has not been generally distributed.

We first gave the rules which had been adopted by the American Printing Company, under the supervision of Mr. Thomas J. Borden, for its safe storage and use, which we now repeat.

Fall River, Mass., Feb. 4. 1882.

Dear Sir,— In reply to yours of the 2d inst. regarding spontaneous combustion of bituminous coal. I would say, that our experience in the matter leads us to believe that it can be avoided. There are three elements that tend to spontaneous combustion of such coal, viz.: The higher the pile, and, resulting therefrom, the greater the pressure,— the finer the coal,— the more dampness there is in the coal,— the greater the tendency to ignite, especially when in contact with wooden posts extending down through the interior of the pile.

We have a bin nearly square, and dump the coal in the centre, consequently nearly all of the finer part of the coal lodges in the centre of the bin, the coarser portion rolling on the slope of the pile toward the outside of the bin. A tunnel or passageway is built of plank, large enough to admit a man and wheelbarrow or car, extending to the centre of the bin, and consequently where the finest coal lies and where the pressure is greatest. Taking the coal for daily use from this point results in a constant change of the coal exposed to the greatest danger, and soon relieves the pressure in the centre of the bin by changing the upper surface of the pile from the form of a cone to that of a hopper or inverted cone. The roof if bin is covered, and for economy it certainly should be should be supported by brick or stone piers, or iron column s, or a combination thereof. No wooden posts should be allowed to extend down any considerable distance into the coal. If wet coal is received, it should be taken directly to the boiler room, and not deposited in the bin, unless on the very top of the pile.

Coal is more generally deposited in bins by dumping, first at one end, and following on to the opposite end, from a platform over the centre of the bin lengthwise. In such cases the fine coal is in the longitudinal centre line of the bin, and the tunnel should be so arranged as to traverse that line instead of working solely at one point in the centre. Where the coal is so dumped as to be evenly distributed throughout the pile, the fine portion cannot be so soon eliminated. There is another element to be considered, viz., the rapidity with which the coal is to be removed from the bin. Our bins will not hold more than three to four months' supply for our works, and therefore the greatest sources of danger are removed within three to four weeks, and there is little danger of the development of spontaneous combustion in a coal pile in that length of time.

especially when the process of removal is continually going on. If the bin held six or eight months' supply, the precautions suggested might not be as effective.

Yours truly,

THOS. J. BORDEN, *Treasurer.*

We next caused an examination to be made by Prof. John M. Ordway, whose report is given as follows : —

MASS. INSTITUTE OF TECHNOLOGY.
Boston, Mass. Feb. 22, 1884.

EDWARD ATKINSON, Esq. :—

Dear Sir,— The spontaneous combustion of coal is owing, I believe, mainly to the oxidation of the pyrites contained in it. Some coals are more liable to trouble than others, not simply on account of their containing more pyrites, but rather on account of the particular kind or condition of the pyrites. There is a difference in the coal itself; for the nearer it comes to non-bituminous anthracite the less the danger.

To favor the oxidation of pyrites there must be :—

1.— Some moisture. When the coal is quite dry there is little danger.

2.— A moderate supply of air. Total exclusion of air would prevent it, and a *thorough* ventilation would also be likely to prevent it. But the thorough ventilation of large masses of coal is impracticable.

3.— A great body of coal For when there is a great mass, frequent renewal of the air in the interior is impossible, so that a local heating will not be checked by a free escape of the heat.

Thus, there is little danger of spontaneous combustion in a mere handful of greasy cotton waste; but a basketful will soon produce such a sum of little heatings as will cause ignition.

4.— A warm place of storage.

5.— Freshness. When bituminous coal is first taken out of the mine it holds some gas, and is a little more inflammable than it is after being kept a year or more

Of course, to guard against spontaneous combustion we must, in the first place, have nothing to do with coals known to be bad.

It should be kept dry and cool.

It should not be stored in large heaps, but divided into piles of moderate size.

The heaps should be examined from time to time by digging in in places to see if there is any heating or any smell.

Though anything like ventilating pipes put in here and there is not to be recommended, I think it would be advisable to put in a few vertical iron pipes, 1 inch or 1½ inch; so that, in case of any smoke or other suspicious appearance, a hose could be attached to either of these pipes, and water from a hydrant let right into the interior of the mass: for it is not easy to reach an internal trouble by throwing water on the surface of a large heap.

A few such pipes extending from a little above the top of the heap to half-way down, and loosely plugged at top, would let in no air, and yet would give vent to any gases or smoke formed below, and would thereby show the locality of any part becoming dangerously hot.

The watchman of the premises should be duly instructed as to the possible danger of spontaneous combustion in the coal heaps, so that he could locate at once any suspicious smoke or smell.

Of course, each individual heap should have space enough around it to allow of ready access, and the top should not come too near the sheltering roof.

Coal that has shown any signs of heating in the hold of a vessel should be thoroughly aired before it is made into a compact heap again.

Yours very truly,

JOHN M. ORDWAY.

The recent threatening case of the heating and generation of a great quantity of explosive gas in the coal storehouses of one of our members, together with five recent fires in soft coal, of which

we have had notice, rendered a further and exhaustive examination of the subject necessary, which has been made by our Inspector, Mr. C. J. H. Woodbury.

There may be little danger of *loss by fire* happening even to other property stored over the coal pockets, for the reason that the heating of the coal generates gas, and this usually gives long notice before the occurrence of fire, so that adequate provision can be made to protect other property from fire; the liability of the underwriters only arises when actual fire occurs. They are not liable for the great injury which the gas itself may cause.

There may be very great danger to the member, therefore, who stores goods over bituminous coal pockets, from the injury which might be caused by this gas pervading the building several hours during the night before it happened to be discovered. There might also be very great danger of explosion, for which the underwriters would not be liable unless fire ensued therefrom.

The subject therefore interests members in greater measure than it does the underwriters.

The exact conditions which induce the actual ignition of soft coals cannot be stated, because instances have occurred in places where the same kind of soft coal has been safely stored and used for a long series of years; yet, without any known difference in quality or method of storage, heat and ignition have finally happened.

From all the sources of information and experience which can be found on this subject, it seems that every variety of soft coal used for generating steam may be liable to heat, under suitable conditions.

These fires are caused by the decomposition of iron pyrites, or possibly organic compounds of sulphur, which may be found in any vein of soft coal.

Heating or ignition is more apt to occur when the coal is damp than when it is perfectly dry.

The percentage of sulphur, determined by the analyses of an average sample made up from the selections of various parts of the pile, may very fairly represent the average composition of the coal, for the purpose of determining its quality; but such analyses, apparently, give no indication or measure of the danger which may exist in some single lump of coal containing just that excess of sulphur required for heating spontaneously.

Analyses of coal which has taken fire show no higher percentage of sulphur than samples taken from piles of coal which have given no sign of heating or of danger.

Another cause of the spontaneous combustion of soft coal is ascribed to heating caused by the absorption of the oxygen of the air by very finely divided particles of carbon in dry coal, in the same manner that lampblack and powdered charcoal ignite spontaneously when subjected to suitable conditions.

The spontaneous combustion of coal appears to have generally occurred around wooden columns, or even around bits of wood, or when chips of wood have fallen in deep in the coal in a close place and have remained for a long time.

The quantity and depth of the coal in a pile appears to be a prime factor in causing danger.

The Parliamentary Commission in 1874 made the following statement relative to the burning of English coal-carrying ships: —

Shipments.	Tonnage.	No. Fires.	Percentage.
2,100	under 500	5	$\frac{1}{4}$
1,501	500 to 1,000	17	$1\frac{1}{8}$
490	1,000 to 1,500	17	$3\frac{1}{2}$
308	1,500 to 2,000	14	$4\frac{1}{2}$
77	over 2,000	7	9

In order that the coal may be stored under the safest conditions, it is, therefore, very important that it should be kept free from contact with wooden columns or wooden surfaces, and also free from contact with any warm masonry, such as boiler settings.

We have the record of one case of the combustion of a wooden column which had been set in the brick work in the rear of a boiler separated from the chamber in which the heat circulated by twelve inches of brick. The coal piled against such a wall would have ignited much more quickly than timber.

A deep pile of coal is more liable to heat than a shallow one; hence the least depth practicable should be adopted.

When the coal is put into the bins or pockets, the remnants of any former supply should be carefully removed, and any damp loads in the new supply should be placed where they will be burned first.

Ventilators should not extend into the coal, as the experience with coal-laden vessels shows that such appliances cannot suffice to remove the danger; and, when the ventilation is limited, the danger is increased; just enough air being supplied to support combustion within the pile, and not enough to cool down any heat which may be produced. It is, however, desirable to have an ample space *over* the pile of coal, with openings at the sides so as to make a free circulation of air, and to remove the gaseous products which are first generated when the coal begins to heat.

Iron rods driven into the coal, and projecting above, indicate heat, if it occurs, and frequent inspections of such rods are practised in some of the works in which bituminous coal is used. This is recommended.

Electric thermostats within the pile are not believed to be desirable, as there would be a great liability to derangement by the supply and removal of the coal itself. The dampness of the coal might also corrode the connections.

In some places it might be very judicious to place thermostats against the ceiling, over the coal.

A small quantity of water, or a shower of water thrown upon a pile of burning coal, cokes it upon the top of the burning mass, and retards any further supply of water reaching the fire. Such fires can be extinguished more readily by the washing down of the pile with heavy streams of water directed against the side.

For this reason it does not seem probable that sprinklers would be of much value over the coal pockets, and they are not recommended.

It will be apparent, that it will be necessary for the underwriters to refuse to grant contracts of indemnity against loss of coal by fire from spontaneous combustion, even though the danger of fire loss may be very small. It will also be very apparent that the danger of gaseous injury constitutes much the larger element in the case, and as this danger is of necessity incurred by the owners of the property, and not by the underwriters, it is to be expected that bituminous coal will not hereafter be stored in such a way as to endanger the property covered by the policies of the Mutual Companies.

We are indebted to Mr. W. W. Greenough, of the Boston Gaslight Company, for valuable information upon this somewhat obscure question.

IV.

FINAL REPORT ON COVERINGS FOR STEAM-PIPES.

The first report upon steam-pipe coverings was subjected to some criticism, because Professor Ordway measured the quantity of heat radiated from a protected pipe containing steam in active

circulation, instead of following the conventional method of estimating the loss by radiation, on the assumption that it would be represented by the thermal equivalent of the water condensed in a pipe of quiescent steam. The comparative results have in every particular sustained Professor Ordway's preference for the method originally used by him in this work, of measuring the actual loss by radiation by means of calorimeters, fitted around the pipe covering.

As the processes employed are of a scientific nature and the results of the final tests are of more interest in science than in practice, it is not deemed worth while to print the final report in full; but the following summary of the whole work may be given: —

First. Air chambers or spaces in pipe-coverings are not advantageous; but it is better to fill hollow places with some light powder.

Second. Compression lessens the actual efficiency of loose powders or fibres, by diminishing the thickness of the covering.

Third. Of all the substances tried, the most advantageous are hair felt, cork, fossil meal, magnesia, and rice chaff.

Slag wool would also be good, if it could be made of a silicious slag free from sulphide of calcium.

At first it might seem as though magnesia is too costly to be taken into account; but with the great abundance of useless magnesium salts in the Stassfurt deposits, and the present exceedingly low price of soda ash, there is nothing but lack of demand to hinder a very economical production of magnesia alba, or even of calcined magnesia, — the lightest and nicest of all incombustible non-conductors.

Professor Ordway's final report upon this subject has been submitted at the last meeting of the American Society of Mechanical Engineers, in whose Transactions it is published. We have ordered a supply of this report, and hold them ready to be sent to any member who desires a copy.

V.

DANGER FROM FANS.

A very considerable loss has lately been incurred by one of our members in a building used for dyeing and drying, which was not suitable to be insured by us, and on which we had refused to issue policies. This fire has been made the subject of close investigation, and is very suggestive.

The building consisted of two sections, divided by a brick party-wall, in which there were wide doorways, fitted with suitable fire-doors. On one side the risk was considered "*bad*," and this part had been fully protected with Grinnell automatic sprinklers. On the other side the risk was considered "*fair*," and automatic sprinklers had not been placed therein, but were about to be.

In this "fair" section the fire occurred, and the section, with its contents, was wholly destroyed. The "bad" section was wholly saved by the automatic sprinklers, the workmen having been driven from the building without being given time to close the fire-doors, so that the fire might have passed except for the sprinklers.

The circumstances were as follows: Stock known as camels'-hair, dyed with chromate of iron, was in process of drying, under the action of a 56-inch fan operating at nine hundred revolutions per minute.

The fire is attributed to the spontaneous combustion caused by the rapid oxidation of the chromate of iron. In a still air it might have smouldered, but, under the influence of the fan, it

burst into flame with the semblance of an explosion; the men were instantly driven from their places and the section was totally destroyed, while the other division was saved in the manner already stated.

The point of interest therefore is, how to stop a fan automatically the instant a fire occurs, by the action of the heat; and this problem may be considered not only in connection with drying machinery, but in connection with all fans, and, perhaps, with some or all blowers.

This can be accomplished by automatically throwing off the belt, and it is probable that a different device may be required for each kind of fan; but in every device a fusible link can be made use of, soldered with the same solder which is used in automatic sprinklers; or with solder melting at a higher degree, if exposed to more than ordinary heat.

We are prepared to furnish fusible links, set at 160 ° F., or to procure others from the Providence Steam & Gas Pipe Co., if any of our members desire to make use of them. In the mean time the makers of the Hawkins Dryer are preparing to fit all their machinery with apparatus for shifting the belt and stopping the fan in the manner described; and in some cases this has already been done.

The constant recurrence of fires caused by friction and spontaneous combustion in the processes of drying fabrics, as well as fibres, keeps us in the constant expectation of loss in the processes of drying, and we therefore again revert to the subject.

DRYING.

With the exception of the Sargent cold-air dryer, properly arranged, every process of drying the fibres of cotton or wool appears to be crude, or in some measure dangerous. No considerable loss has of late occurred, because we have required every dry-room to be protected with automatic sprinklers; but fires are of constant occurrence. It is well understood that, if the heat rises above 120 ° F., the fibres are baked, and in some measure made brittle; yet hot-air drying continues, because of the necessity, or the assumed necessity, of rapid work.

The preceding suggestions may perhaps obviate the danger arising from the use of fans or blowers; but, with the approval of the Directors, Mr. Woodbury has been instructed to investigate every process now in use, and to see if a science of drying in a safe and rapid way cannot be developed, or else to provide the necessary safeguards to meet dangers which cannot be removed. Any suggestions upon this subject will therefore be very welcome.

VI.

TESTS OF WOOL OILS.

From the number of samples of oils which have been sent to us within the past few months to be tested for adulteration, we may assume that there has been more than usual difficulty in obtaining a pure lard oil.

As we understand the customs of the trade, a great deal of oil is sold as lard oil which is not made exclusively from lard, but which contains a great deal of so-called grease oil, which does mischief in greater or less degree when applied to wool.

It is also a matter of constant necessity, on the part of those who use olive oil, to avoid danger of adulteration with cotton-seed oil.

Up to this date it has been expedient for all members who have not an expert chemist in their

employment, to send samples of oil to us to be tested; the method being the application of what has long been known as the "Elaidine test," or nitro-sulphuric acid test, which consists in impregnating the oil with nitric-oxide gas, thereby causing a chemical change, — the liquid oil being converted into a solid, white, wax-like cake, when it is either pure lard or pure olive oil.

The acid is somewhat difficult of preparation; and, since it does not hold the gas permanently, unless kept in stoppered bottles with the greatest care, the work could be satisfactorily done only in a laboratory; but a method has lately been presented which serves the same purpose, and which can be practised by any expert dyer or manager of a woolen factory.

The chemicals and apparatus needed are, —

First. A stock of lard or olive oil of known purity.

Second. Nitric acid of 1.34 specific gravity, or 37° Baumé.

Third. Some small conical-shaped wine-glasses, with some short glass stirring-rods.

Fourth. A good thermometer.

Fifth. Some copper wire, about $\frac{1}{32}$ of an inch in diameter, No. 56 American wire gauge, or of such a size that, in lengths of $\frac{3}{8}$ of an inch, six will weigh one gram, or forty will weigh one quarter of an ounce.

Sixth. Apparatus for keeping the glasses at a temperature of 60° Fahr., for two hours, which may be either an air chamber or a basin of water, kept at that degree of temperature, the temperature being a very important point.

The directions for making the tests are as follows: —

Place five cubic centimeters (about one teaspoonful) of oil in a wine-glass, add an equal quantity of nitric acid, drop in one of the bits of copper, and place the glass at once in the water, where it will be maintained at 60° Fahr.; stir occasionally, or at intervals of ten minutes, for the first hour, in order that the gas, which begins to form at once, may come in contact with every particle of the oil. As soon as the first piece of copper is nearly dissolved, add a second. This should furnish a sufficient quantity of gas, if the liquid has been kept cool, and if the stirring has been rightly done. At the end of one hour, pure lard or olive oil will show white, waxy flakes, and, on standing without disturbance for another hour, the oil will have changed to a solid white cake.

Pure cotton-seed oil shows no flakes whatever. Petroleum oils usually show black gum-like flakes on standing twelve hours, but undergo no other change.

Mixtures give a pasty mass, more or less solid according to the proportion of the adulterant.

After one or two trials with oils of known purity, it would be a very simple matter for any expert in the dye-house to test every lot of oil in this way. We shall be ready, however, as before, to make tests of any oils which are sent to us as suspected of adulteration.

Another test of the adulteration of olive oil with cotton-seed oil has been lately published in the *Chronique Industrielle*. It was discovered by Professor Bechie, of Florence.

"To five c.c. of the suspected oil, add, in a small flask, twenty-five c.c. of alcohol of ninety-eight degrees, and mix well. Then add five c.c. of a solution prepared by dissolving one gramme of nitrate of silver in a hundred c.c. alcohol of ninety-eight degrees. Heat on a water-bath to about eighty or ninety-five degrees. Heating with a direct flame must be avoided. If the sample contains cotton-seed oil, — even a very small quantity, — the mixture will color, and take a tint more or less pronounced according to the amount of cotton-seed oil it contains."

Upon applying this test at the Institute of Technology it has been found a very certain one; but it can as yet be applied only in a laboratory, because alcohol of sufficient strength must be specially prepared, not being for sale.

VII.

LANTERNS.

Nothing has given us more difficulty than the subject of watchmen's lanterns, and there is no subject on which we have been obliged to subject our members to what they might, perhaps, consider a petty annoyance.

In justification of our constant reminders, and of our attempts to meet the wishes or prejudices of agents, while at the same time securing safety, we again call attention to the fact, that the losses in the Boston Manufacturers Mutual Fire Insurance Company only, before we took up the subject, which could be attributed with more or less certainty to the breaking of lanterns, amounted to over $240,000; which sum represents nearly a million dollars to all the Mutuals. Since we took it into consideration, there has been no considerable loss from the breaking of a lantern, although there have been some rather narrow escapes.

We have been asked to devise a movable lantern which would give more light than the ordinary oil lantern, for the use of mechanics, when engaged in night work. The Metzler Railway Signal Lantern Company of New Jersey, whose address is 4948 Germantown Avenue, Philadelphia, make a very solid, durable, and safe brass lantern, of the largest size, fitted for the burning of sperm oil, which will give as much light as it is easy to obtain from any movable lantern. This lantern is of the very best and most durable workmanship, and will be sold by them on direct orders, at $5.00 each.

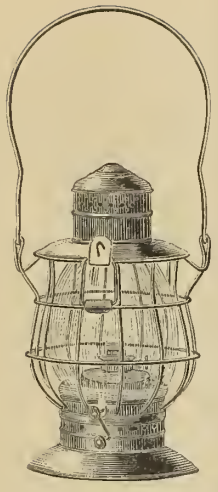
We object to the use of movable kerosene lanterns. Most of those which are sold are very badly constructed, and are insufficiently guarded; and, in view of the danger, if the lantern breaks, of the material spreading the fire with great rapidity, we think it injudicious that they should be used.

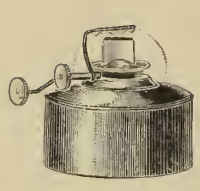
Some of our members have desired a lantern which would open at the bottom, and we, at one time, approved a lantern of this construction, into which the lamp was screwed and apparently locked with safety; but after short use it appeared that the screw-thread was liable to wear out, the lock did not catch, and, in several instances, the lamp dropped out.

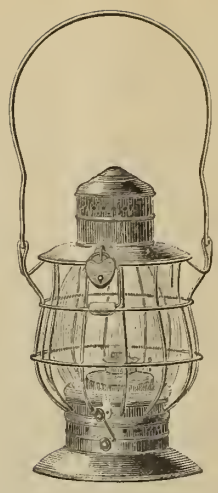
The reason given for the use of such a lantern was, that it was difficult for a watchman to pick the wick of a lantern which opened at the top; it being said that it subjected him to danger of burning his hand, and that he would then drop the lantern and thus increase the danger of fire in place of lessening it. In answer to this, it is held that a watchman should be peremptorily forbidden opening a lantern, for the purpose of picking the wick. It is undoubtedly to this practice that some fires may be attributed, of which the cause has been very obscure; the bits of crust which form on the wick of a lantern in which lard oil is burned, holding their heat and fire long enough to ignite fibrous substances.

We can recommend nothing so safe or suitable, for ordinary use, as the lantern lately devised by F. O. Dewey & Co., Canal Street, Boston, in which they have succeeded in meeting our requirements for a lantern, of which the wick can be raised or lowered, and which can also be cleared of crust, if any form upon it, without opening the lantern. A diagram of this lantern is given herewith.

The device for removing the crust from the wick may, perhaps, be worked so as to extinguish the light, but this is wholly unnecessary; and, if a watchman complains that it puts the light out, he should be reprimanded, and instructed how to use it. He should also be instructed only to operate this apparatus when in a porch. If he puts the light out, he should not be permitted to use a match or relight it in the mill, but should go back to the boiler-house to relight or get a new one.







If the little device for clearing the wick does not appear to work in a satisfactory manner, it can be set at a more acute angle to the line of the wick; or it can be bent upward so as not to scrape the wick in so close a manner.

But the great difficulty in this matter is not with the lantern; *it is with the oil.* Sperm oil, of the best quality, is the only suitable oil fit to be burned in a watchman's lantern, although lard oil is commonly used. It is admitted that the price of sperm oil is customarily one-third more than the price of pure lard oil; but in order to test alike the economy, safety, and suitability of oils, we have lately burned several kinds, for several days, keeping a record of the results.

Three kinds were selected: first, pure sperm oil, furnished by E. T. Milliken & Co., 61 Broad Street, Boston; second, pure lard oil, furnished by the same parties; third, lard oil which had been chemically treated for the removal of albuminous substances, by the Davis Oil Company, of New York. Each of the lard oils burned sufficiently well until the oil in the lamp was about half consumed. Each then began to burn dimly and finally failed, leaving a residuum of about one-third part of the oil unfit to burn. Of course, when the lamps were filled with fresh oil on the top of the residuum, they burned less well and would finally become useless. Sperm oil burns clearly and well until it is all consumed, there being at the end a very few drops left, insufficient to be taken up by the wick. Sperm oil is therefore the only suitable oil to be used; and, in view of its complete consumption, it does not cost any more than lard oil.

VIII.

BASEMENT FLOORS.

The various special or general reports which have been issued during the past few years have become very voluminous, and are in some unimportant matters inconsistent with each other, our more recent experience having altered the conclusion first submitted, although not in any important particular affecting the safety of the property insured by us.

Since there is an increasing call for them, the undersigned is now engaged in compiling and condensing all the information which is in our possession, with a view of putting it into a single volume, if it shall hereafter become expedient to reprint.

In the course of this work various questions have arisen which are only indirectly connected

with the subject of insurance,— among others, the right method of preparing the floor of a one-story mill without a basement story; or the floor of the mill of ordinary construction in the basement, in the engine-room, or in the auxiliary buildings.

Two destructive fires have occurred, which originated, one under the floor of an engine-room which was separated from the ground by about three feet; this fire was probably caused by the spontaneous combustion of oily waste carried underneath by rats; another, which was set by an incendiary, through the orifice left in the rear of a storehouse to ventilate the space underneath the timbered floor.

The writer had also become fully conversant with the want of durability in basement floors constructed of timber, and separated by only a few feet from the ground, during his experience as treasurer of cotton factories; and he has been a witness to this difficulty in yet wider measure since he took the supervision of a Mutual Insurance Company.

No kind of concrete appears to have been invented in this country, nor could the writer find one in England, upon which it is considered safe to operate fine machinery without a covering of plank or boards, owing to the danger of fine dust being raised from the surface by the disintegration of the material.

Timber laid in or plank laid over cement or concrete appear to be subject to very rapid destruction.

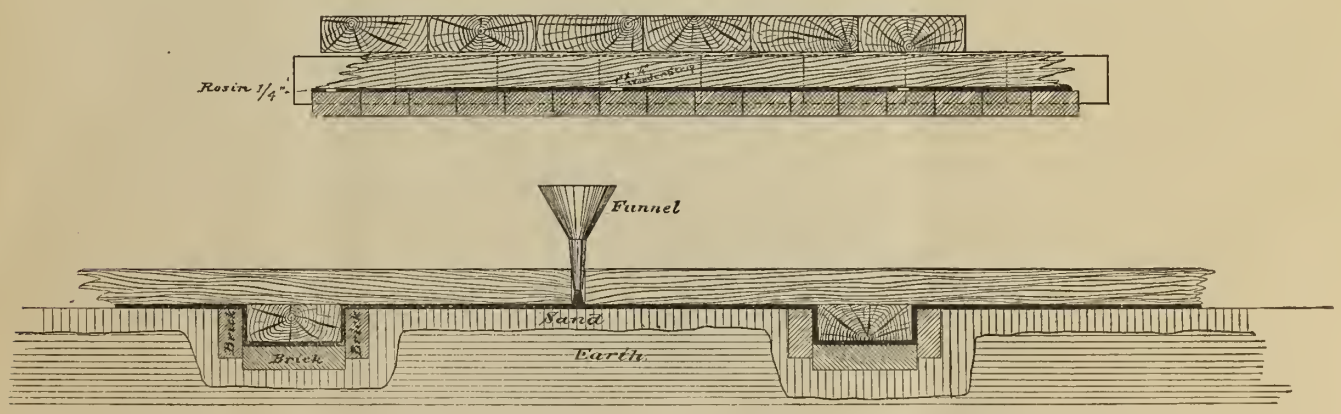
The ordinary air space which is left under a timber floor when not laid directly upon the ground, or upon the concrete, can rarely be kept so dry as to avoid rapid decay of the timbers, especially at the ends, where they rest upon the foundation walls.

The writer therefore undertook to find durable basement floors in some of the works of our members, and he now submits the specifications of two kinds of floor which have stood the test of time.

The one which we shall first describe is to be found in the works of Messrs. William Sellers & Co., of Philadelphia.

This floor has been laid for twelve years, and upon examination by our Inspector, who made the inquiry, it was found to be in as good condition as any of the flooring in the upper stories. The pitch of the yellow pine was as fresh as when first laid.

The following diagram may be referred to.



Method of Laying Shop Floor as used by Wm. Sellers & Co.

The specifications are: —

"The earth is first removed, so that it does not approach either the floor timbers or the plank, and a layer of sand fills the space. Spent molding sand was used in this case. The timbers are then placed in the trough made by the brieks, which bricks are laid without mortar. Melted resin is poured into the space alongside the timbers, which are also placed so that the resin will flow underneath, protecting the under side The floor planks were then laid upon the timbers about half an inch above the level of the sand. Melted resin is then poured through holes bored in the floor plank about four feet apart, so as to interpose a layer of resin between the sand and the underside of the plank. Upon this under floor the top floor is laid, in the usual manner."

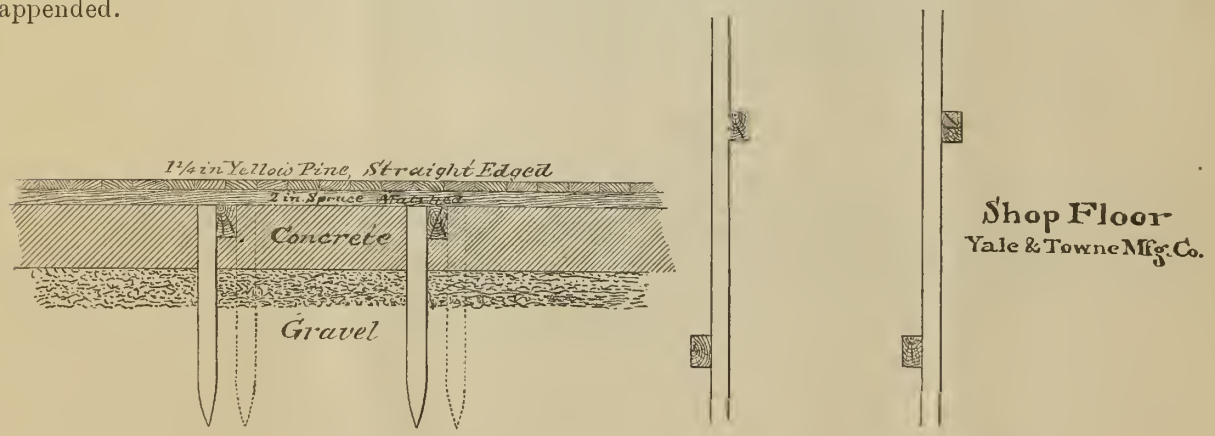
The cost of a floor like this could not be ascertained; but Messrs. Sellers & Co. regard the freedom from annoyance and from the expense of moving the machinery, and the saving in the repairs of the floor, as the greater points to be considered.

The second kind of floor was found in the works of the Pratt & Whitney Co., Hartford, Conn., and is described by them as follows: —

"In laying a basement floor, about eighteen years since, of 10,000 square feet, 8,000 feet were laid in coal tar and pitch concrete in about equal proportions. 2,000 feet were laid over cement concrete. The latter portion of the floor was renewed in about ten years, the timbers and the plank being completely rotted out, while the other was in a perfeet state of preservation, and has continued so until the present time. How much longer it will last we cannot tell.

"Excavation was made about one foot below the floor, and six inches of coarse stone were filled in, then five inches of concrete made of coarse gravel, eoal tar and pitch, and finally about one inch of fine gravel concrete. Before the eoncrete was laid, heavy stakes were driven about three feet apart, to which the floor timbers were nailed and levelled up. The concrete was then filled in upon the floor timbers, and thoroughly tamped underneath up to the level of the top, rounding the concrete between the floor timbers and rolling it down. Upon these timbers the floor was laid. The timbers on the under side of the flooring were covered with hot coal tar. It is very essential that the gravel should be perfectly dry before mixing, which is done by putting hot eoal tar upon the gravel, and raking it together. In order to get the mixture so that it will be dry, hot pitch should be mixed with it, and boiled so that when cool it will become perfeetly hard. What is known as distilled or refined eoal tar must be used, as that which comes from the gashouse without being refined does not work in a satisfactory manner."

Another floor substantially corresponding to this mode of treatment is found in the works of the Yale & Towne Manufacturing Company, at Stamford, Conn., of which we have been kindly furnished by the managers of the works with a complete description and specification, hereto appended.



In reply to my questions, they state that they have one floor, 50 x 100, laid in this way, which has been in use three years. Another, 300 x 82, which has been in use eighteen months, both periods being too short to serve as bases on which to speak definitively of the endurance of the flooring; but in view of the experience of the Pratt & Whitney Company this point may be considered as fully settled.

IX.

SYSTEMATIC FIRE INSPECTION.

The practice of systematic fire inspection, under the supervision of the manager of each mill or works, is becoming more common, and should be universally adopted.

We give first a plan which has been suggested for weekly inspections of one of our largest risks, and which is to be adopted subject to such modifications as the superintendant may find expedient.

Instructions.

Inspections shall be made every Saturday by boards of three overseers, one of whom shall be apointed by the Superintendent every week, and hold the position three weeks. They shall examine, and report upon this schedule, from personal knowledge, the condition of each room in respect to its general order, noting whether the machinery, especially in closed portions, is as clean as the several operations will allow; and that all pipes and fittings and fire apparatus are in good order; and also report anything which appears to be detrimental to the best interest of the mills.

The specific matters are to be reported on this schedule with O if satisfactory, and X if criticised; fuller explanations may be added, when necessary, in the remarks below.

All corrections shall be made by order of the Superintendent; and the inspectors shall not give any directions, except in their report.

INSPECTORS' WEEKLY REPORT.

The undersigned report the result of their examination of the mills as follows:—

BUILDINGS.	Casks and Pails.	Waste and W. Boxes.	Steam-Pipes.	Hydrants.	Hose and Fittings.	Closets and Benches.	Fire Doors.	Dirt around Steam-Pipes.	Gas and Water Pipes.	Lanterns.	Pumps tried or turned.	Elevator Hatches.	Unclean Machinery.	General Order.			
West Div. Cotton . .																	
Middle " " . . .																	
East " " . . .																	
Div. A. Picker . . .																	
" B. Waste . . .																	
" C. Boiler . . .																	
" D. Repair . . .																	
" E. Dye																	
Packing and Office . .																	
Div. A. Print Works .																	
" B. " " .																	
" C. " " .																	
" D. " " .																	
" E. " " .																	
Storehouse																	

REMARKS.

[NOTE. — As an alternative for the first column (Buildings), we suggest "Departments." For instance, card-room, spinning do., weaving do., and have report apply more directly to rooms.

This method would deal personally with rooms, but would necessitate the use of more sheets.

With the above form, a fault in the weaving-room of West Div. would show a × in that line in the check-list, and explained at length under "Remarks."]

Signed,

. . . . . } *Inspectors.*

We next give the instructions under which a system of inspection has been in operation, for many years, in one of our largest metal-working risks.

Instructions for Inspection of Fire Apparatus.

Each inspection is to cover the entire premises of the Company.

1. The Inspector will examine every hose connection, move every hose valve or cork, and see that the hose is properly connected and readily accessible for use. Also see that every fire bucket is filled with water, and that each fire lantern is filled, trimmed, and ready for use.

2. The Inspector will carefully examine the surroundings of every steam boiler, stove, and heater, to see that no inflammable materials are near them, that all smoke and flue connections are tight, stove pipes well secured, and everything safe.

3. The Inspector will carefully follow the line of every steam-pipe, throughout its whole length, to see that it is not in contact with wood, and that no waste or other inflammable materials are near it. In summer this need apply only to such pipes as are then in use. In winter ALL steam-pipes must be so inspected. Any leaks in pipes or valves are to be immediately reported to the Superintendent.

4. The Inspector will carefully examine spaces beneath all work-benches and tables, and will remove therefrom any inflammable materials he may find. All cases of carelessness which he may note in this inspection to be promptly reported.

5. The Inspector will particularly examine all places where oil, varnish, alcohol, lacquer, japan, etc., are stored, to see that every precaution is taken against fire. He will also inspect every receptacle for dirty waste, to see that it is in proper order and place.

6. The Inspector will note the condition of the yards, and see that no accumulation of inflammable materials occurs near any of the buildings.

7. Once monthly the Inspector will carefully examine every chimney used for fires to see that its joints are tight, particularly near the roof or other wood work, and that no inflammable dirt is collected near it.

8. Once each month the Inspector will take down and uncoil every fire hose, leaving it extended over night, and replacing it properly the next day. In doing this he will note the condition of the hose, and see particularly that it is not becoming cracked or injured by the method of hanging or otherwise. All defects in hose to be promptly reported to the Superintendent.

REPORT.

To the General Superintendent:

I have to report that on ..... I made a thorough inspection, in accordance with the above instructions.

I found the instructions numbered ..... to have been properly complied with, and everything in the place and condition designated.

I found violations of the instructions numbered .....

I report the following matters as needing attention, viz.:

.....

.....

I make the following suggestions for the better protection of the property, viz.:

.....

.....

Inspector.

X.

ELECTRO-MOTIVE POWER.

Nearly one quarter part of our risks being now furnished with dynamo-electric machines for purposes of lighting, the following statement of the special use to which the electric lighting plant has been put in the Pemberton Company may be of interest.

By calling attention to this application of electricity as a motive power, we do not intend to endorse or approve it until it has been under supervision for a sufficient period to determine all the conditions. We merely call attention to this instance, as the second application among our members of an electric lighting plant to other purposes, to which our attention has been called. In the first instance the application was made about two years ago and has been continued ever since. In this case a Daft motor was made use of. If successful and safe, there may be many other ways in which such application may be made, which will be greatly to the benefit of underwriters.

There is often a good deal of work in a mill yard for which it would be very convenient to have a small portable steam-engine. It may perhaps be possible to mount a small electro-motor on wheels so as to make it easily portable; to anchor it where needed, and to operate it with a wire from the dynamo machine.

For many purposes, especially for night repair work requiring special power, such apparatus might be very desirable, since power and a safe incandescent light might be furnished from the same wire at the same time.

The six-horse power dynamo in use in the Pemberton Store-house weighs between 1,100 and 1,200 lbs.

A two-horse power motor could be easily carried by two men, and anchored wherever needed. It may be suggested that special machine shop tools could be operated on repair work at night in a much safer way than to run full lines of shafting from the wheel or engine. Perhaps calico-printing machines may be operated in this way, and even special departments of mills in which extra work is required to meet emergencies, if the shafting is so adjusted that the lines especially needed can be cut off from the rest.

Lawrence, Mass., November 12, 1884.

Edward Atkinson, Esq., *President*: —

Dear Sir,— The Pemberton Company have just finished putting an elevator into their store-house on the corner of Canal and Union Streets. The elevator is one of the latest improved, with self-closing hatches, and of sufficient size to carry six bales of cotton. The power for driving this is by means of a six-horse power, Sprague electric motor,— one of the identical machines shown and operated in the late electrical exhibition at Philadelphia. The electricity for propelling the motor is furnished through two wires from our Edison dynamos situated in the mill about one thousand feet away from the motor. As we only use the elevator in day-light, having nor using any artificial *lights* in the store-house, the dynamos, which supply 450 lamps in the mill when needed, have always by day sufficient surplus to supply the motor at the store-house.

Yours truly,

F. E. Clarke, *Agent*.

XI.

AUTOMATIC SPRINKLERS.

During the last two years the list of expirations of each month has been carefully revised, in order to record the progress which had been made toward complete sprinkler protection up to the present standard. This standard is an adequate provision of perforated pipe or of automatic sprinklers, in textile factories over all departments in which the stock is worked in a loose condition, from the opening to the spinning rooms inclusive: in the attics of high mills, or of other mills of which the roofs are not of the best construction; in drying-rooms and over dry-can machines; in wood-working and all other hazardous departments of all works insured by us.

We began to advise this measure of protection about four years since, because, in view of the increasing amount of property in almost every mill-yard, greater safeguards were needed; also, because the wish of our members to have their whole risk covered by Mutual Companies could not be assented to without this precaution. At that date about one hundred and twenty risks were protected up to the standard with perforated pipe-sprinklers. A few of our members, whose risks were then protected by perforated pipe-sprinklers, have voluntarily substituted automatics; and one mill, the Sagamore, has been destroyed for want of prompt action in opening the valves to pipe-sprinklers in the upper stories, there being no sprinklers in the basement, where the fire started.

The following statement substantially gives the present condition of all the risks insured by the Boston Manufacturers' Mutual Fire Insurance Company. There may be one or two very large corporations in which the work on all the mills is not fully completed, and there may be some cases in which the agreements have not yet been carried into effect: —

No sprinklers needed	40
Perforated pipe adequate	114
Partly perforated pipe and partly automatic	81
Automatic adequate, complete, in progress, or agreed	443
Inadequately protected, and under notice that the policies cannot be renewed at the next expiration, unless suitable provision is made	8
Total	686

Our inspectors are now instructed to examine every system critically, so that no point of danger may be left unguarded, and that no inadequate service or supply pipe of too small a capacity may escape notice.

The Parmelee Automatic Sprinkler began to attract the attention of the undersigned in the years 1877 and 1878; in which years eight fires were extinguished by it in works insured by this Company, without any loss. In 1879 the sprinklers operated four times, with a loss on one fire of $512.77. We then began to urge the adoption of the system, and the foregoing report gives the conclusion of the matter at the present standard of adequate protection.

Up to this date, Dec. 1, 1884, automatic sprinklers have been called into action by fire in 158 cases,—partly in works insured by the Mutual Companies, and partly in other premises; and where

they have been in the rooms where the fire originated, they have not yet failed to extinguish the fire, or to hold it in check until other apparatus could be brought into use, except in one instance, where the main valve was closed and the water shut off (not insured or inspected by the Mutuals).

Out of this whole number of 158 instances, 83 fires have occurred in the years 1879 to 1884 inclusive, in mills or works which were insured by this Company.

In 54 of these fires in which the automatic sprinkler has thus been called into action, no claim has been made for loss.

In 29 fires claims have been paid by this Company to the amount of . .	$8,365 92
Average loss to each fire (83) in which the automatics have worked .	100 79
Average of each claim (29) on which a loss has occurred . . .	288 48
Total loss to all Mutuals in these cases	32,800 92
Average loss to each fire (83)	395 19
Average of each claim (29)	1,131 07

In this same period, 1879 to 1884 inclusive, to the latest date of the computation in the latter year, this Company has received notice of 436 fires which have taken place in which the automatic sprinklers were either not in place, or did not act because the fire was extinguished with buckets or other appliances. In this number there were 181 instances in which a loss occurred, against 255 without loss.

Loss to this Company in these fires	$733,553 09
Average loss each fire (436)	1,682 46
Average loss each claim (181)	4,052 78
Loss to all the Mutual Companies in these specific fires in which this Company was interested	3,285,540 22
Average loss each fire (436)	7,535 64
Average loss each claim (181)	18,152 16

We respectfully refer to the proportion which each claim for loss under the automatic sprinkler ($1,131.07) bears to each claim where they were not present ($18,152.16), in justification of our urgent advice for their adoption, and in support of our judgment that they have already saved the members of this Company more than they have expended in putting them in position.

I make this comparison on claims for loss, rather than on the number of fires, because we are sure to receive notice of all the former, but we are also certain that we are not informed of all the latter, as we desire to be.

This comparison does not yet cover a sufficient period to be very conclusive; but it is the only statistical justification we can yet offer.

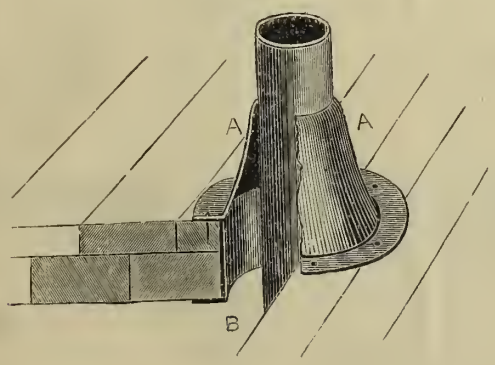
Many of our members, taking warning from the destruction of the Craven & Willard woollen mill, and the Annisquam and Sagamore cotton mills, are now protecting weaving-rooms, porches, and engine-rooms with automatics; others are substituting automatics for perforated pipes. While we may not *now* be justified in asking any additional expenditure, we hope a small portion of the first profits of business, or our next year's dividends on mutual insurance policies, will be appropriated to the complete protection of every risk in every department, except those risks which are of such a description as not to require any apparatus of this kind.

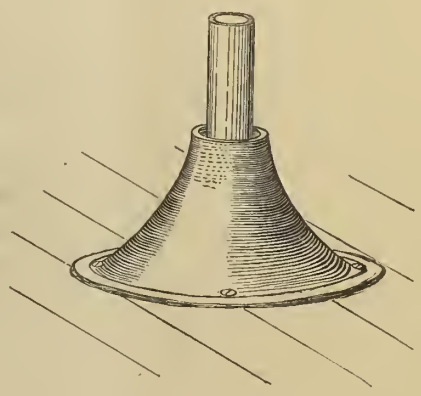
XII.

STEAM-PIPES IN FLOORS.

Our inspectors frequently find the spaces which have been left around steam-pipes, where they pass through floors in order to protect contact with wood, clogged with waste and dirt. Within a week a specimen of roving waste has been recovered from such a place, which was carbonized to a dangerous point.

Such spaces should be kept clear; and a request has often been made for a form of metal casing which should fully protect the wood, and, at the same time, be free from liability to become clogged; for which purpose a casing of iron, cast in two pieces, is suggested, of which we submit diagrams.





XIII.

HEATED BEARINGS.

In our first report upon lubrication, a method of measuring the heat developed upon a heavy bearing by means of thermometers packed in water was described. A suggestion was made that it would be a very simple matter to invent a suitable electro thermostat which would give immediate warning of any heat being developed upon a bearing long before the point of danger had been reached.

This suggestion has been acted upon by more than one inventor, and we now suggest the adoption of the apparatus of which the descriptions are given herewith. The cost is trifling compared to the security which it may give against fire; but it may not be simply for this reason that this precaution should be taken.

Bearings which are not liable to heat to a dangerous degree may yet be subject to a costly measure of friction, for want of proper adjustment, thereby requiring an excess of power. In order to detect even this measure of friction, so inexpensive an appliance as the one now described may be well worth adoption.

It has frequently happened that bearings have been found to be so hot as to make it impossible to bear the hand upon them without scorching, which, until such examination, had been assumed to be in a perfectly satisfactory condition.

DIAGRAM
OF
JOURNAL BEARINGS.

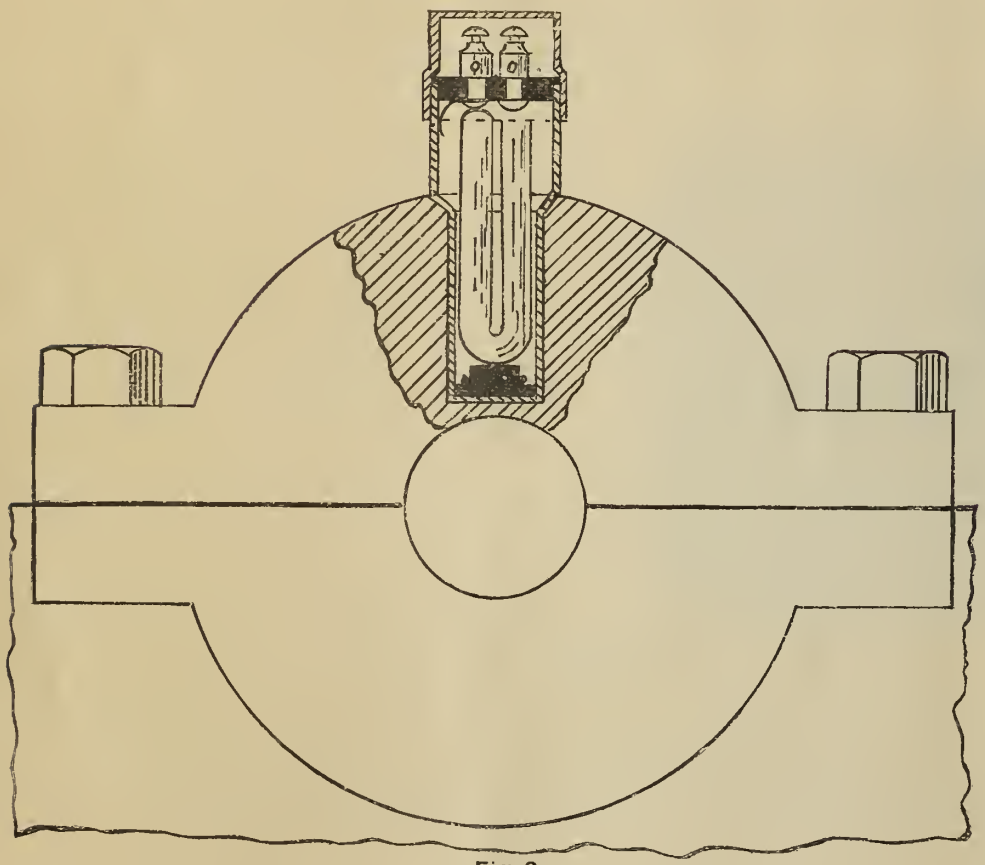


Fig. 2.

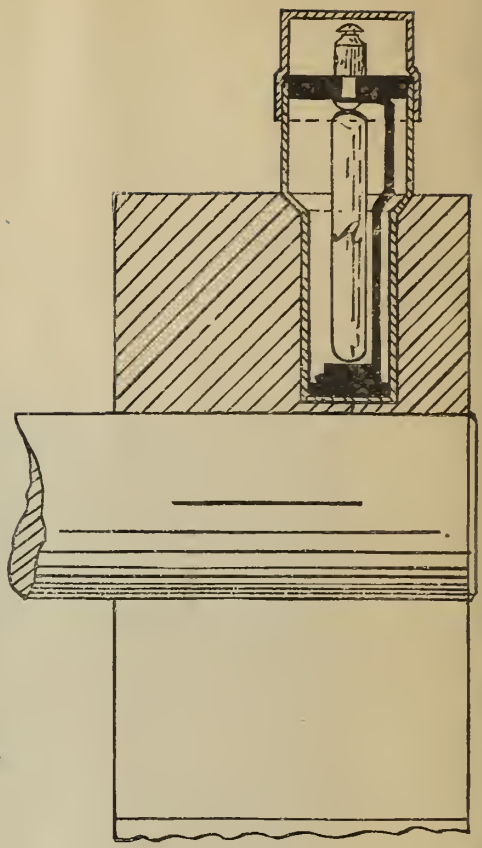


Fig. 1.

FIG. 1 shows the longitudinal section through the Thermostat attachment and the box and journal.

FIG. 2 shows a transverse section.

Referring to the illustration, it will be seen that this instrument consists of a glass U tube, with arms of equal length, the left one being closed. The left arm contains a small amount of hydro-carbon liquid, and the remainder is filled with mercury.

When the temperature exceeds any fixed limit, a small amount of hydro-carbon is vaporized, and its expansion forces out some of the mercury, which collects at the bottom of the case, and forms an electrical connection between the two poles and completes the circuit.

The Thermostat is two and a half inches long, and one-half inch in diameter, being round like a cartridge tube; but it is made of various lengths to accommodate the depth of journal box, so that it shall reach near the shaft itself.

A cover over the top of the case, of the same metal, renders it absolutely waterproof, and protects it from injury.

If it should be tampered with or broken, the accident would spill enough mercury into the cup to sound an alarm.

It is so compact, so complete in itself, and so small, that it is free from harm by accumulation of either dirt, grease, oil, or water; thus it can be placed as well in the basement of a mill or elevator as in the attic.

This apparatus will be furnished and placed by the AUTOMATIC FIRE ALARM ASSOCIATION, 40 Water Street, Simmons Building, Boston.

XIV.

AUTOMATIC FIRE ALARM.

The Mutual underwriters do not customarily urge members to place an automatic fire alarm in works which are well protected with automatic sprinkling apparatus which may itself be so arranged as to be a most effective fire alarm; but many members have adopted an electric fire alarm, and others desire to do so. We have therefore been requested to examine several systems. In addition to the methods of the Automatic Fire-Alarm Association, No. 40 Water Street, Boston, of which one of the applications has been described in the foregoing statement in regard to heated bearings, it is expedient to call attention to the apparatus of the MARTIN AUTOMATIC FIRE-ALARM ASSOCIATION, No. 246 Washington Street, Boston, upon which Mr. Woodbury makes the following report.

"The Martin Automatic Fire Alarm is a system by which the heat from a fire causes an alarm bell to receive a certain number of strokes, and drops an annunciator tag bearing the same number, thus signalizing the location of a fire both by sound and by sight."

"I have on several occasions examined this system and witnessed its operation, and consider it extremely sensitive to heat, and reliable under all circumstances. In its arrangement and construction it provides for every known contingency which could interfere with its operation."

"Instead of limiting the service of the electric apparatus to measures for giving alarms of fire, devices which are alike simple in their construction and ingenious in design give warning by an inspector's indicator, where the ringing of a bell which is distinct from the fire alarm, and the exposure of a tag, records any interference with the conducting wires, either by cutting, crossing, or connecting to the earth. If the battery is becoming weak, this apparatus notifies the inspector forty-eight hours before it becomes inoperative, while the automatic removal of a resistance preserves the strength of the working circuit. Should any portion of the system come in contact with conductors leading to the ground, other than those provided for in the general arrangement, then the system is automatically changed to a metallic circuit, which is not, as is well known, interfered with by the single accidental ground connection, and preserves its efficiency as a fire alarm, while the indicator summons the inspector."

"These various calls for an inspector are announced upon the indicator in different methods; so that the character of the difficulty, as well as its cause, are brought to the attention of the inspector. After the most severe tests, I have been unable to disarrange the system without also sounding the indicator alarm; and the failure of these attempts confirms me in the opinion that the fire-alarm bell, with its visual notice, cannot be operated except by heat, and that any interference will give instant notice upon the inspector's indicator with its bell and tag."

"Notwithstanding the compass of its operations, the mechanism by which all this is accomplished is far from complex, and a single circuit wire would suffice for seventy-five or more buildings."

XV.

AUTOMATIC FIRE DOORS.

In Special Report No. 10 we gave the specifications for the construction of a fire door composed of wood encased in tin, and also described a method of hanging and fitting the door so that it might be closed automatically by the heat of a fire.

For the latter purpose a very much simpler and very inexpensive apparatus is now furnished by the Providence Steam & Gas Pipe Co. We advise its use and its substitution for the more complex and uncertain apparatus devised by us.

XVI.

REMOVAL.

The Offices of the Boston Manufacturers, Arkwright, Mill Owners, Cotton & Woolen, Spinners, and Rubber Mutual Fire Insurance Companies have been removed to No. 31 Milk Street, Boston, Upper Floor.

Each Company has a private room, only occasionally occupied for Directors' meetings and for other similar purposes. Any member or agent will be very welcome to make use of one or the other of these rooms for business appointments, or for the purpose of correspondence; and they may also have their letters sent to our address, if it will be a convenience. As we often obtain very valuable suggestions from the managers of the mills or works insured by us, their visits will be more than welcome and we shall be the better satisfied the more they act upon this invitation.

Respectfully submitted,

EDWARD ATKINSON, *President*,

31 Milk St., Boston.

December 1, 1884.

Associated Mutual Fire Insurance Companies.

Quarterly Report No. 2.

Boston, Nov. 1, 1884.

The last three months have been singularly free from any heavy losses. The record, covering small losses, will be continued, beginning August 1.

In another part of this report, under the title of "Belt Boxes and Belt Orifices," an account will be found of a fire which occurred in the works of the A. H. Hart Co., New York, in the latter part of July, but the details of which had not been sufficiently reported for inclusion in Quarterly Report No. 1.

No. 1. Fire in cotton-pickers. Buckets only used. Loss, $51.34.

No. 2. Fire in finishing room of a printery, fully described in the Postscript to our last quarterly report. The manager of the print-works is of opinion that the "greys," which took fire, ignited before they had been through the drying cans, and not afterward, as stated by us. In either case, the loss may be attributed to the oxidation of dye-stuffs in a drying department which was not protected with sprinklers.

No. 3. Fires caused by lightning, described as follows: —

About five o'clock in the afternoon of July 12th, during a heavy shower, the lightning seemed to strike in the immediate vicinity of the mill office. About fifty lights of glass were broken by the accompanying crash of thunder in the mill opposite; one man was knocked down in the machine shop (which is in same building as office), and all of his fellow-workmen were more or less affected.

The current, following the wires of our electric clock, entered the mill buildings, causing slight fires in three different places in the yard, as follows: —

In belt-shop, over office, where clock wires all enter, the window-frame through which wires pass was found to be on fire, quite a blaze having started when discovered, while the wires *inside* clock in room below were found burned off in three places.

In No. 1 card-room, fourth story, the cotton lint collected on clock-wire was found to be on fire, even the covering itself having ignited; this was put out with wet waste.

In No. 2 upper spinning-room (fourth story), in same way the current followed wires, and ignited cotton lint on same, and it was put out with a few dippers of water. Since this experience we have had "arresters" put on wherever the wires enter mill buildings, and a large wire leads from them to the ground.

No. 4. Fire in the dust under the brushes in the cloth-room of a cotton factory. Put out with small hose. No claim.

No. 5. Fire in breaker-lapper in cotton mill, caused by nails in the cotton. Buckets only used. No claim.

No. 6. Fire caused by friction in a roving frame. Buckets. No claim.

No. 7. Fire in the loft of mill stable. No cause assigned. Loss, $75.

No. 8. Fire in picker of a woollen mill, working on a mixture of wool and cotton, dyed blue. Eight sprinkler heads opened, and sufficed to quench the fire; but a zealous town fire department insisted upon using an engine, and, by scattering the stock with a stream of water, increased the damage somewhat. Loss, $208.44.

No. 9. Fire in cotton opener. Doors immediately closed. Automatic sprinklers held the fire until aided by pump. Trunk slightly scorched, and a little cotton burned. Loss small; not yet claimed.

No. 10. Fire between two oil safes in a boiler-room. Cause of fire suspected to be the watchman's pipe. No claim.

Watchman broke four "hand grenades," so-called, without effect, and then extinguished the fire with a bucket of water, justifying the preference which we have expressed for buckets of water over all other small apparatus. There may be some places where hand grenades will serve their purpose, provided they retain their virtue for any length of time; but we do not wish a single bucket displaced in their favor; and we do not think it desirable that any delay should occur in a resort to pumps or hydrants after buckets have failed, such as might happen in the attempt to use these bottles charged with water and carbonic-acid gas.

No. 11. Spontaneous combustion of dyed cotton. Put out by watchman with hose. Loss, $50.40.

No. 12. Spontaneous combustion of dyed cotton. Put out by automatic sprinklers, pump used a few moments. Loss, $50.

No. 13. Fire in cotton picker, caused by the friction of cotton winding round the feed rolls. Extinguished by one hand grenade. A bucket would have served as well. No claim.

No. 14. Fire in bleachery, probably caused by a spark from locomotive engine. Our loss was on goods only. Total claim on goods in which the Mutuals were interested believed to be $2,347.35.

No. 15. A small loss in a flax mill, from the overflow of water in the basement, happening during the extinguishment of a fire in storage sheds not insured in the Mutuals. The end windows of the factory toward these sheds had been protected with wooden shutters, encased in tin, as the condition of being insured in the Mutual Companies. These shutters were sometimes lapped by flame, and were exposed to great heat, but were unimpaired. Loss by water not yet settled; estimated at $2,000.

This is the second time, during the first year in which this mill has been insured by us, that it has been saved from very heavy damage by the safeguards taken prior to admission.

No. 16. Fire at 4.30 P.M. in a cotton-mill picker, probably caused by a match. When discovered it was spreading rapidly over about forty bales of opened cotton. Six automatic sprinklers worked promptly, and, in the opinion of the man in charge, would have taken care of the fire; but to make sure, the steam-pump was started. No damage to building or machinery. Stock slightly burned, but badly wet. Loss small; not yet settled.

No. 17. Fire in a wool-picker, caused by some hard substance in the wool, spread over about two thousand pounds loose stock. Hand grenades thrown upon the soft mass did not break. Fire extinguished mainly by buckets and perforated pipe-sprinklers. Loss not settled. About $500.

BELT BOXES AND BELT ORIFICES.

In almost all mills recently constructed, the driving belts are carried in a separate chamber, cut off from the main rooms of the factory by fire walls; but a very large number of our older risks are exposed to the danger of fire being carried through belt boxes or belt openings, from one room to another; or, if the fire occurs in the engine room, from there to all the rooms in the mill at the same time.

No destructive fire had ever originated in an engine room until the loss of the Flint Mill. Since then we may attribute the loss of the Annisquam Mill to the same cause. In this latter case the engine was in the lower story of the mill.

We have urgently called attention to the need of keeping belt boxes clean, and we have also suggested a sufficient number of automatic sprinklers to be placed around the belts, in order to check a fire passing through the openings.

Objection having been taken to placing automatic sprinklers very near the main driving belts, lest they should be opened by accident and the belt be injured by water, we have suggested that the belts should be enclosed in a glazed chamber, and that the automatic sprinklers should be placed outside the glass.

We assumed that in such a case the heat would start the sprinkler outside the glass before it had been broken, and thus prevent the passage of fire, but that the glass would save the belt from damage by water in case a sprinkler head were opened by an accident.

During the present year the flax mill of the A. H. Hart Co., of New York, had been insured upon condition that every room in the main mill should be fully protected with automatic sprinklers; for which purpose the owners selected the Walworth Manufacturing Company's sprinkler.

The engine room was the lower room in a structure four stories in height, upon three sides of which were working departments of the factory. The belts were carried up in a section of this building which was separated from the rest by a partition, in which partition there were windows. In the part of the building devoted to the belts there was no working machinery; but the three upper floors were protected with sprinklers, the engine room not then being thus protected.

On a Sunday evening a relief watchman entered the mill, took off his coat, and hung it up in what was assumed to be a fire-proof oil-room adjacent to the engine room, with a lighted pipe in the pocket of the coat. This started a fire, which worked through the door, passed through the belt boxes, which were made nearly all of iron, and started four sprinklers in the room next above the engine room, four in the next, two in the next, and one upon the other side of a window in the room adjacent to the belt chamber. The fire was wholly extinguished by the sprinklers in these rooms, and was stopped at the window. The belt was slightly injured, but the total damage did not suffice for the basis of a claim upon the underwriters. The engine room has since been protected with automatics.

It would therefore appear that our suggestions have been fully justified, including the suggestion to place sprinklers outside of a glazed partition to prevent the fire passing from a glazed belt chamber to the working departments of a factory.

We trust that this statement will lead every member to give especial attention to this matter; and we urgently advise every member whose mill is now protected only in all the departments in which the stock is worked in the loose condition, but is not protected in the weaving room with automatic sprinklers, to place a sufficient number of automatic sprinklers in the weaving room to prevent the passage of fire from belt openings to other parts of the room; and we enforce this advice by again calling attention to the fact, that the woolen mill of Craven & Willard was set on fire in an unoccupied end of a basement. The fire went from there to the weaving room, where it gained such headway that the mill was completely destroyed, although the automatics in the upper rooms kept the fire out of those rooms until the posts burned off below.

And also in the case of the Annisquam Mill, the fire passed from the engine room to the weaving room, which was unprotected; and that mill was destroyed by fire in that room, while the sprinklers in the spinning and carding rooms above were in full operation.

Respectfully submitted,

EDWARD ATKINSON,

(President Boston Mfrs. Mut. Fire Ins. Co.),

for the Associated Companies.

REMOVAL.

THE BOSTON MANUFACTURERS MUTUAL FIRE INSURANCE CO.

THE SPINNERS MUTUAL FIRE INSURANCE CO.

THE ARKWRIGHT MUTUAL FIRE INSURANCE CO.

THE MILL OWNERS MUTUAL FIRE INSURANCE CO.

THE COTTON AND WOOLEN MANUFACTURERS MUTUAL INSURANCE CO.

THE RUBBER MANUFACTURERS MUTUAL INSURANCE CO.

HAVE REMOVED TO

No. 31 Milk Street.

Upper Floor,—Rooms 51, 52, 53, 54.

MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

The Committee appointed to visit the School of Mechanic Arts and the Lowell School of Design of the Massachusetts Institute of Technology beg leave to report as follows, to wit :—

Each of these two departments of the Institute is now in good working order and is producing such results as to warrant a great extension of their work ; but for such extension adequate preparation must be made. What has been done during the past year in the construction and equipment of the present workshops is excellent as far as it goes, but insufficient with reference to the future.

THE SCHOOL OF MECHANIC ARTS.

The present building was planned and built mainly for use as a workshop. The original plan was altered so as to make temporary provision for the school proper, and also for drawing rooms ; but if the suggestions now submitted are adopted, the whole of this building will be required for what is now known in our course of instruction as "shop-work."

Carpentry, blacksmithing, moulding, forging, filing, fitting, and turning, both in wood and in metal, are thoroughly well accommodated ; the rooms devoted to drawing serve their purpose exceedingly well, but more room will be needed for mechanical drawing if the school is enlarged, and that part of the building at present occupied as the drawing room of the School of Design may also be better devoted to other purposes.

The room now occupied as a school-room is unsuitable for permanent use for such purpose.

If adequate provision is made elsewhere, the rooms now occupied for drawing and design may therefore be devoted in part to an extension of the shop-work now practised, and the shop-work may be extended so as to include soldering, brazing, polishing, brass finishing, fine work on instruments of precision, and pattern-making. The room now occupied for school purposes is absolutely necessary to any adequate instruction being given in the adaptation of textile designs to the looms in which such designs are to be worked. Aside from any attempt to teach specifically the art of weaving, more space and more looms are needed for such use in the Department of Textile Design.

THE LOWELL SCHOOL OF DESIGN.

Under the judicious system of examinations for entrance, and the limitation of the number of pupils in this department, more excellent work has been done this year than ever before. The drawing room has served its purpose very well, but, as has been stated, the room devoted to looms is entirely too small, and the looms can only be worked eighteen hours a week because of the interruption to the school in the next room, which is caused by noise and vibration.

The mechanic art shops are now fully justified in their connection with the Department of Mechanical Engineering of the Institute proper, and now serve as a necessary mechanical laboratory for the use of students in that department, and also for those in the Department of Building and Architecture ; but the Mechanic Art School, as such, both in regard to manual and mental instruction, has not yet found its true place, nor can the results of its course of mental instruction be rightly taken as a standard of what it might accomplish, in view of the grave disadvantages under which it has been conducted from the beginning.

Your Committee are of opinion that this school cannot be creditably maintained as it is, but should now be established on a broader foundation, if it is to be continued at all.

In this connection the other members of the Committee (Mr. Runkle being one of the number) may say that in their judgment Professor J. D. Runkle has done one of the most useful services which has ever fallen to the lot of any one engaged in teaching to perform, in the establishment of this School of Mechanic Arts. He has not only laid the foundation for a simple and inexpensive method of combining manual with mental instruction, but he has also provided a truly scientific substitute for the obsolete method of apprenticeship. Whatever may now be the course taken by us with this school, the seed which he has planted is already bearing fruit throughout the country.

The surrender of the vantage already gained in this direction by the Institute is not to be considered for a moment, and your Committee, therefore, urgently recommend the corporation to establish this School as a Secondary School of Applied Science, to occupy the same place with respect to the principal courses of instruction which are now given in

the Institute proper that the regular high school occupies in its relation to the college or university, the laboratory work to be mainly devoted to mechanics.

To this end the following steps should in their judgment be taken :—

1st. The proposed school building should be constructed at once according to the original plan,—70 feet by 50 feet and four stories high.

2d. The course of instruction should be extended from two to three years, and should be so planned as to be a complete course in itself, analogous to that of a high school, and also to serve as an adequate preparation for entrance to the higher courses in the School of Industrial Science.

3d. The school in all its departments should be placed under the charge of a competent director, devoted wholly to its work, and, as far as possible or expedient, the work of instruction should be carried on by its own special corps of teachers.

4th. It should have its own distinctive name, and, while holding its integral and essential place in the Massachusetts Institute of Technology, it should have its separate function as a Secondary School of Applied Science, equal in its plane to the higher school which now constitutes the principal work in our undertaking.

In order to accomplish these objects, or even to provide the necessary accommodation for the School of Mechanic Arts, as it now is, your committee urgently recommend the immediate construction of the proposed school building.

This building may be a very plain structure, built substantially like our new building on our home lot (which building now needs a distinctive name). If constructed of the proposed size, 50 x 70, 4 stories high, it will contain 14,500 superficial feet of floor surface. Your Committee have had no plans or estimates made, but judging by analogy with the cost of a factory of the most substantial kind, it may be assumed that the cost need not exceed $1.50 per square foot of floor ready for apparatus and equipment. A most substantial cotton factory—built of brick, with heavy timbers, eight feet apart on centres, three-inch plank floor sheathed underneath, with 1¼ inch top floor; flat plank and gravel roof with monitor for vertical light in the upper room—can now be constructed at a cost, above the foundations, of eighty cents per square foot of floor. It may be safely assumed that seventy cents per foot of area covered would amply suffice for the necessary piling and foundation, and also for such divisions into separate rooms as may be called for. At this rate the cost would be $21,750. It may also be safely assumed that the sum of $3,250 would suffice for the cost of heating, plumbing, and other apparatus, making a total cost of $25,000. It is assumed that the upper room would be assigned to mechanical drawing and to the School of Design, for which very little additional equipment would be required at present; and it may also be assumed that very little equipment would be needed in other parts of the building beyond what we now have, except as it might be called for by the increase in the number of pupils.

It is held that, having already invested more than $100,000 in land, buildings, and equipment for these two departments as they now are, the investment of this additional sum, even if borrowed, is now called for merely on commercial considerations. Our investment does not pay as it now is, but by the addition of this amount of capital, it is believed that the whole may be made to pay.

It is believed that this school may be carried to two hundred pupils within a very short time, and may then become profitable in the mere commercial sense, and it is held that we shall have the same experience in this that we have had in other branches of our work, to wit, that we shall be sustained in the number of our students, and therefore in our current income as well as in gifts and bequests, in the exact measure in which we prove ourselves competent to provide adequate room and teaching force to meet the increasing demand upon us. When we have faltered or delayed in the past, we have for the time lost ground; when we have been prompt and vigorous in our action, we have always gained, and have always been sustained.

Another purpose may be covered by a very slight addition, if any, to the proposed expenditure. Between the proposed school building and the present boiler-house there will be a space which by merely roofing over may be converted into a department in which a variety of experimental work may be carried on, such as has already been conducted by Professor Ordway, Mrs. Richards, and by students or graduates of the Institute.

Reference may be made to the study of lubrication, in which more accurate results have been attained by means of special machinery, invented for the purpose, than have been approached elsewhere; and these experiments have led to the rejection of very many dangerous oils formerly in common use, and to the substitution of safe lubricating oils at very greatly reduced cost.

Various oils which are offered for use on wool are now constantly sent to the Institute for the detection of adulteration. An investigation of the many substances which are offered for covering steam pipes and boilers for preventing the radiation of heat has been in part completed and will soon be finished, which promises to bring this somewhat obscure subject to known terms and conditions.

For such work of investigation as the foregoing, and also for experimental work in dyeing and bleaching in connection with the art of weaving, and for other similar purposes, this space will serve an excellent purpose; it may also be considered as one of the methods of beginning the establishment of a complete textile laboratory in the manner recently proposed by the chairman of this committee.

It will be observed by reference to the plan that after the erection of the school building and the covering in of the area in the centre of our lot in the manner proposed, there will still remain fully 15,000 feet of our land unoccupied.

This may be reserved for a textile laboratory and weaving school if in time the development of these departments shall be called for under the direction and control of the Institute.

Mr. William Mather, member of the Royal Commission on Technical Education, gave the conclusions which he had derived from his observations in this country, somewhat as follows: "That in the higher technical instruction, preference was to be given to the schools of this country over any similar schools in Europe, especially to the Hoboken Institute and to the Massachusetts Institute of Technology, but that there is in the United States a great lack of what may be called Secondary Schools of Science, and an absolute want of Weaving Schools and other appliances for instruction in the Textile Arts."

Since the plan of a complete Textile Laboratory had been proposed by the chairman of this Committee on his own responsibility, and submitted by him personally and not as a member of the committee or of the Institute, he requested another member of this Committee to prepare a statement of whatever ought to be said in regard to the subject to be submitted to the other members, and adopted if concurred in by all. In this way the following paragraph, addressed in the first instance to the chairman of the Committee, has become incorporated in this report.

"With regard to your 'special hobby,' it may be considered a foregone conclusion that we must have at some future time a fully equipped Textile Laboratory. The buildings now proposed for immediate construction should be planned with a view to future additions being made for this purpose, whenever it shall become possible or prudent to enter upon this extension of our work. The School of Design, with its Weaving Department and the Experimental Dyeing Department, may be considered as a nucleus, and the rest will follow as a matter of course and of necessity. The textile machinery now accumulating in the Rogers Building should be removed thither as soon as suitable room can be provided. The general plan of the course of textile instruction proposed may well be incorporated in this report, although it does not come within the scope of what is now recommended for immediate adoption by the corporation."

In conclusion your Committee beg to submit that both themselves and the other members of the corporation may now have a much more adequate conception of the way in which the Secondary School of Applied Science should be established and developed than the founders of the Institute had when the Higher School of Industrial Science had its small beginning in the little rooms in Summer Street only about twenty years since.

They submit that in the plans now proposed they are only extending the method so admirably developed by our late President Rogers, in the first Physical Laboratory, on a broader scale and in a yet more necessary field, to wit, that of the instruction of pupils younger than those who can be admitted to our higher courses of instruction, in the application to useful work of head and hand combined.

May we not rightly appeal to the imagination when we ask the consideration of this plan for adding to our present four years' course a preliminary training for three years, which by itself may suffice for some of the pupils, but which, when preceding the full course, will offer a seven years' apprenticeship in a complete school of applied science, as a substitute for the method of technical education of earlier days which has become obsolete with the change in the methods of industry, and in consequence of the division and the scientific necessities of modern labor?

If it is objected that the Corporation is now indebted for as large a sum as prudence will permit, it may be answered that we now have absolute assurance of the future receipt of sums of money more than equal in the aggregate to what we now owe, with the sum now proposed to be expended in addition thereto. By making this expenditure we shall be prepared to do all the work which we have as yet undertaken in the best manner, and the extension of the textile department which has been presented may safely wait until persons who are directly interested in the textile arts shall furnish the money for its foundation.

Respectfully submitted.

Edward Atkinson, *Chairman.*
James L. Little,
J. D. Runkle,
Samuel D. Warren,
M. D. Ross.

Boston, Mass., May, 1884.

Plan for a Textile Laboratory and Course of Instruction in the Textile Arts.

The annual value of the textile industries of the United States already amounts to more than $600,000,000, and that of the imported fabrics to more than $125,000,000. For this great industry there is no special training of the youth who intend to prosecute it. Efficient practical courses of instruction might be carried out at the Massachusetts Institute of Technology if a well-appointed building, provided with textile laboratories and a textile museum, were erected for the purpose. The first two years' course of instruction in the Institute is admirably suited as a basis for the future special study of textile manufactures, and it is in the next two years of the curriculum that special training should be followed. The first two years would ground the student in modern languages and mathematics, in mechanical drawing, in general geology and chemistry, as well as in the practical work of the physical and chemical laboratories, and will thus prepare him for entering upon the special course of textile industry.

The foregoing computation of the value of the textile industries is given for the domestic fabrics at the factories and for foreign fabrics without duties. If the cost of wholesale distribution and the duties be added, the wholesale value of textile fabrics used in the United States by those who convert them into garments is, in round numbers, $800,000,000. About one eighth of this quantity consists of carpets, hosiery, embroideries, and other goods of like kind which are ready for the consumer; perhaps an equal quantity consists of silks and fine fabrics, of various kinds, which are more than doubled in value by the addition of the supplies used and the labor put upon them by those who convert them into garments. About $600,000,000 in value consists of the useful staple goods which are consumed by the million. Sometime since I had occasion to investigate the value of woollen and worsted cloth when converted into clothing, and the value of cotton when converted into shirts and other common garments. In each case I found that the clothier, the shirt-maker and others, who consume these goods, about double their value by the addition of supplies and labor thereto. In a rough and ready way, it may therefore be said that the value of the clothing of the people of the United States, ready for final distribution to them, is $1,400,000,000, and if to this sum be added the carpets, hosiery, laces, etc., first named, the total value of textiles used in the United States, when made ready for the consumer, is *fifteen hundred million dollars a year*. This is, I am confident, a very close approximation. The Department of Textile Industry now proposed would lie at the foundation of this immense superstructure. Ought it not to be solidly established?

The professional studies might then be substantially as follows, covering two years: —

1. *Geology*, specially applied to the formation, distribution, and character of soils, and also as to their disintegration and preparation for culture. *Physical Geography and Climatology*. These subjects would be studied with reference to the production of animal and vegetable fibres.

2. *Economic Natural History and Botany of Plant and Animal Producing Fibres*. Laboratory practice in sorting wool, stapling cotton, and conditioning silk.

3. *Applied Physics*. Laboratory practice in the use and application of the microscope, polariscope, and photography to fibres and fabrics.

4. *Mechanical Engineering*. The use in and application of steam, water, and electric power to factories; shafting, belting, etc.

5. *Building and Architecture*. Special study of the construction of factories; prevention of fire; vibration as affecting the wear of machinery, the health of the operative, etc.

6. *Mechanics*. The theory of all machines which are used in the textile arts, with laboratory practice in preparing, carding, spinning, and weaving fibres.

7. *Textile Design in all Branches*. Special instruction in the preparation of designs suited for different materials. Laboratory practice in the art of engraving copper rollers as well as wood-cutting for printing, and also in the art of weaving.

8. *Industrial Chemistry*. Laboratory practice in the preparation and use of mordants and dyes, in the various methods of bleaching, and in the discharging of colors; in the preparation of the cloth for the various processes of dyeing and printing.

9. *History*. The connection of the textile arts with the history of nations and of the causes which have led to their rise and decline in relation to special industries.

10. *Political Economy*. The connection of the textile arts with the condition of the people of various countries, to which might well be added a few lectures on business law, forms of contract, and the like.

Textile Museum. A complete textile museum, such as now forms a part of the apparatus of instruction in the weaving school in Crefeld, Germany, would be essential to our complete success. It may here be observed that many of the students who attend the Crefeld school intend to become merchants, and they take the course of instruction in weaving and dyeing in order to qualify themselves to be intelligent judges of the quality of goods.

Dye House. A small but well-equipped dye house would be needed unless the Laboratory of Industrial Chemistry, which will by and by be established, should prove adequate to the purpose.

EDWARD ATKINSON.

To the Members of the Boston Manufacturers Mutual Fire Insurance Co.

Gentlemen:

I am permitted to include this missive, together with a report upon the Mechanic Art School of the Institute of Technology, in the same wrapper with a Special Report, a large part of which consists of the statement of valuable work done at the Institute on behalf of the Mutual Underwriters.

About a year since the undersigned ventured to propose the establishment of a Textile Laboratory, coupled with a course of instruction in the textile arts, as a department of the Institute; which proposal was sent separately to all the members of this Company, and in response thereto a considerable number of subscriptions were made to this undertaking; but the times have not been propitious for so large an enterprise; considerable progress has, however, been made in the required direction.

In the Lowell School of Design may be found a Crompton loom, a Knowles loom, and a Lewiston Machine Company's loom, each of which has been given by their respective makers, together with a hand-pattern loom, for the use of students in that department.

In the department of Mechanical Engineering will be found a carding-engine, given by the Whitin Machine Co; a drawing frame, given by the Saco Water-Power Machine Co.; a Mason mule, given by the Mason Machine Co.; a speeder, fly-frame, and spinning-frame, given by the Lowell Machine Shop; a yarn tester, reel, and other apparatus, given by the Brown & Sharp Manufacturing Co.; a machine for testing and properly adjusting belts, which was devised and built at the Institute; together with other apparatus which would ultimately form a part of the Textile Laboratory, but which is now used for purposes of instruction in the science of Mechanical Engineering, with the incident result of habituating the students to the operations of textile machinery.

The immediate friends of the Institute — many of whom had given large sums before — contributed during the past year a trust fund of $250,000 in memory of our late President, William B. Rogers.

The Corporation has also incurred as large a debt as prudence permits in completing the new buildings of the Institute proper, the present workshops, and in furnishing adequate equipments both to the higher course of instruction and to the course of instruction in the mechanic arts.

We have now ample room and adequate appliances for the *higher* courses of instruction in the Institute proper.

Our laboratory of Industrial Chemistry is organized, and will soon be furnished with a one-color printing machine, and with other apparatus to be applied to dyeing, printing, and other arts analogous thereto.

But our Mechanic Art Department still lacks a suitable building, and must remain crippled and incapable of doing its full work, until its premises can be enlarged.

The undersigned is Chairman of the Committee charged with the special oversight of this department. He ventures to ask contributions to be applied to the construction of the school building which is called for in the report, for which the Corporation does not now feel that it would be prudent to incur any further debt.

Five of his friends, members of the Mutual Companies, to whom he has presented this case, have already agreed to contribute $1,000 each, conditional upon the full sum being raised.

This school is almost a necessary antecedent to the course of instruction in the textile arts. For this reason, and in view of the specific services of the Institute and of its Professors and students to the underwriters as such, as well as to the several members of the Mutual Companies, may not the undersigned hope to receive contributions for the purpose indicated?

It would not be fitting for him to make a personal solicitation on behalf of the Institute, except among his own friends with whom he could take that liberty.

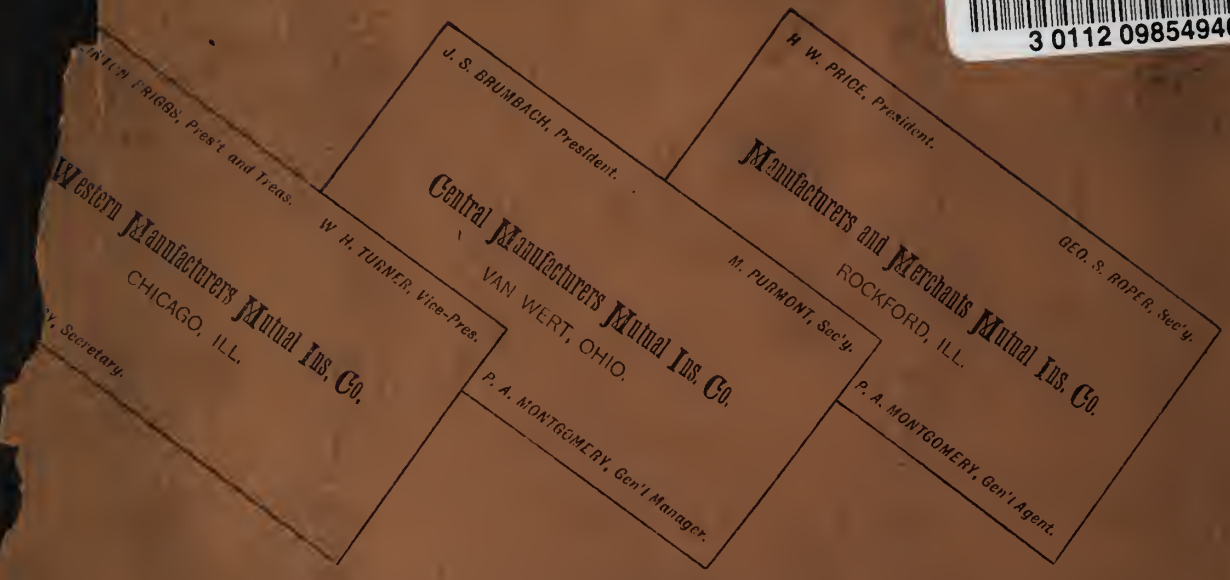
It may not, however, be considered unsuitable for him to make this statement, asking each member to act upon it as his judgment and sympathy may lead him to do.

Very respectfully submitted,

EDWARD ATKINSON.

he Mutual Underwriters Union

CONSISTS OF



...ach making its own contracts of indemnity independent of the others, but for the sake of economy, employing the ...e inspectors, thus dividing expenses.

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These are the ONLY PURELY MUTUAL Companies doing a general business with Manufacturers in the Northwest and issuing NO POLICIES ON THE STOCK PLAN.

NO PERSON OR FIRM HAS ANY AUTHORITY TO REPRESENT ANY OF THESE COMPANIES IN ANY MANNER EXCEPT THE DULY AUTHORIZED GENERAL AGENT and MANAGER, THE OFFICERS OF THE VARIOUS COMPANIES AND THEIR SALARIED INSPECTORS.

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All communications regarding insurance or improvement of risks should be addressed to

P. A. MONTGOMERY,

Secretary and General Agent.

115 AND 117 MONROE STREET, CHICAGO, ILL.